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The Showdown

AT this writing it is believed that the President will call a special session of Congress in November to take up the proposed shipping legislation. The failure of the United States to adopt a constructive shipping policy has prevented private capital from investing in marine securities. It has caused us to tie up so many vessels that over one-half of the entire idle tonnage of the world is composed of American ships. It has compelled the Shipping Board to carry in its own vessels, under a system of managing operators, the far greater majority of our foreign overseas commerce.

Delays and postponements of the time of settlement of the shipping problem have injured our merchant marine and our foreign trade. If the House of Representatives is not given an opportunity to act on this measure before the appropriation bills of the short session come up, there is no telling when action can be obtained. In other words, the time has arrived when the needs of the country demand a showdown on the question of protection for the American merchant marine.

Protection has been freely given to our manufacturing industry. It has raised our standard of living, which affects every other industry, including shipping and shipbuilding. It has made domestic investments inviting and it can be safely said that American capital will not seriously attempt the shipping business until protection is assured.

Protection is right in principle until an industry is able to stand on its own feet. The shipping bill contains many provisions for developing our shipping. It is based on the facts and findings of the best committee of marine experts, irrespective of their political affiliations, that the Administration could get together. There will be an honest difference of opinion on some of the features which are more or less discriminatory in nature but the main provision, whether it is called a subsidy, compensation or a retaining fee for National defense should be favorably acted upon immediately.

The Jones Act compels the Shipping Board to operate our vessels under Government ownership until private capital can be interested in taking them over. The present board is doing this work as efficiently as it is possible to do it where the incentive of private interest is lacking. Government ownership is an abomination to the average business man but it is better to maintain a merchant marine under the present conditions than to drop back to where we were in 1914. If the Great War demonstrated anything, it proved the fact that a merchant fleet is necessary for our commercial prosperity and absolutely essential for the security of the Nation.

The Cost of New Ships

A STUDY of the bids offered for the construction of vessels during the last two months indicates that the bottom prices have been reached and that prospective owners who are delaying placing their orders will lose rather than gain by playing a waiting game. It is known that quite a number of coastwise vessels are contemplated for which contract plans and specifications have been or are being prepared. Special types of vessels for foreign commerce are also under consideration and the passage of favorable shipping legislation would undoubtedly bring them out.

While it is not believed that a contract for the construction of a new ship can be placed as cheaply as it could have been last spring, nevertheless better prices can be obtained now than in the future. In this connection the recent raise in the wages of the employees of the United States Steel Corporation, the continued increase in unfilled steel tonnage orders, the results of the railway strike and the coal strike are very good indications that the cost of both wages and materials is upward.

It is true that several shipyards have made sacrifices during the last year in order to get contracts so that they could hold their organizations together. But this will not be repeated except in exceptional cases for reorganization and

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retrenchment having been accomplished and there is nothing to be gained by taking a contract that means a loss.

Shipowners should realize that shipyards are governed by the same laws that apply to other lines of business. They can produce the cheapest only when the volume of work is sufficient to keep all of their departments constantly busy. Therefore to hold up work, particularly on a rising market, until the shipyards are in a position to demand high prices, as they certainly will be if the subsidy is passed, is almost certain to result in a loss of both time and money.

Reserve Engineers

THOSE who have followed the sea or lived in the desert never forget. Whether it is the vastness of the ocean on the one hand or the lone level sands stretching far away on the other, there is a fascination for those who have traversed these great bodies of land and water which typifies as nothing else on this earth of ours the greatness of the universe that once felt will always remain.

So we are glad to learn that the engineers which the shipping depression have cast upon the beach have formed a shore division of the Ocean Marine Engineers' Association. These men who, temporarily at least, are forced to seek employment ashore hold sea-going certificates of which they are justly proud. And the possession of one of these tickets entitles the holder to mingle with the men on active sea duty and keep in touch with the news of the sea.

Without such an organization the whereabouts of the engineers leaving the beach would become unknown. The Government would thus lose a ready means of manning their ships in a time of emergency and this would be no small undertaking; for a minimum of four engineers is required for each vessel. So it is hoped that this organization of reserve engineers will meet with encouragement and the best way we can help these men who are loyal to the sea but must have work is to advise the Ocean Marine Engineers' Association, 15 Whitehall Street, New York city, of any job on a stationary plant that comes to our attention.

The South Has the Most to Gain

ALTHOUGH the shipping bill has not been made a party measure, nevertheless the chief opposition to it lies in the Democratic party. The senators and representatives from the South must be blind to the interests of their section of the country, if they allow their deep rooted prejudices against protection to influence their votes against a subsidy for shipping.

Knowing, as they must, that Southern ports are nearer to the great continents of South America and Africa and, at the same time, closer on the average to the center of production of the United States, which is a short distance southwest of Indianapolis, Indiana, it seems unbelievable that any Southern statesman would oppose any reasonable legislation that would develop our carrying trade under the American flag.

With Europe impoverished, no part of the country has more to gain from the development of American foreign commerce in the next fifty years than the South. Africa and South America are two vast undeveloped sections of the world. Their natural wealth and almost unlimited resources present opportunities to American genius and capital that are not to be compared with anything that Europe has to offer. Both of these continents look to the United States for the money, equipment, materials and skill that are necessary in a period of development.

If the Southern representatives vote against the shipping bill they will be doing nothing less than opposing the building up of a very lucrative trade that would naturally flow through the ports of the Southern states. And, furthermore, they would be directly aiding England and Germany with their advantage of cheap production to obtain for themselves the trade of Africa and South America. The United States cannot hope to secure her share of this commerce which will probably be greater in value than that from any other countries for some time to come if she does not bend every effort and utilize every opportunity to facilitate its development.

Prohibition That Does Not Prohibit

THE enforcement of Attorney General Daugherty's ruling will not cause the high seas to be one bit dryer. It will simply mean that those who desire the privilege of drinking wines and liquors *en voyage*—and in this class must be included a large percentage of Americans as well as foreigners—will select vessels over which we have absolutely no jurisdiction outside of the three mile limit.

Attorney General Daugherty holds that the intent of the framers of the eighteenth amendment in the light of the context was plainly to prevent the transportation or consumption of liquor wherever the United States held jurisdiction. We believe that the question of selling liquor on ships never entered their minds because there were so few American passenger ships engaged in foreign trade at that time.

One of the greatest arguments in favor of national prohibition was that it was impossible to keep one State dry while its neighbor was wet. This is just as true of vessels plying on the same route. Foreign vessels cannot be controlled and there will be an inducement to every member of the crew of American vessels to become bootleggers.

Neither is it the custom to examine passengers' baggage on embarkation. To do so, if it can be legally done, as the Constitution forbids the customs to tax exports, would be only one more incentive to avoid American ships and not to do so would mean that a large percentage of the class of people who can afford to travel abroad would carry their own. Whatever may be one's personal opinion of prohibition he certainly knows that it is far better to have the sale of good liquor under the control of the captain of the ship than the uncontrolled indulgence in bad liquor in the staterooms at all hours of the day.

If the passengers on our ships were limited to Americans, enforcement of the Volstead Act would be more consistent but we rely on securing our share of the foreign passenger trade. In preventing citizens of other countries from enjoying their customary beverages we are adopting a "holier than thou" attitude which is bound to work to the disadvantage

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of American ships in more ways than one. For instance, in order to build up foreign trade, we have to do business with merchants of other countries. If these merchants when traveling on American ships feel insulted or, on account of prohibition, elect to travel on vessels of our competitors, we are apt to lose their trade. And this trade is vital to the prosperity of every employer and employee in the country.

Attorney General Daugherty's ruling also affects every American cargo ship in the foreign trade; for our vessels will be prohibited from accepting shipments from one foreign port to another, if there is any liquor in the manifest. Taking it from whatever angle you wish, this ruling will accomplish nothing but harm to American vessels. And by placing such a handicap on our merchant marine, we may find in a time of emergency that we lack the vessels that would give our Navy the power to prevent just such a catastrophe as occurred in 1914.

Co-operation of Rail and Water Transportation

ONE of the most important provisions of the pending shipping bill is that which provides for the creation of a joint board made up from members of the Interstate Commerce Commission and the United States Shipping Board; this board to have the function of securing proper co-operation of rail and water transportation.

Once again the prosperity of our farmers is vitally affected by the lack of adequate railway facilities. According to an address recently delivered by Mr. Samuel O. Dunn before the annual meeting of the Associated Business Papers, "the farmers cannot ship the crops they already have harvested, and the wheat has not all been threshed and the corn is not yet gathered. Every single industry in the country is reporting that its shipments, and many that their production, are being restricted by lack of transportation."

The railroads lack freight cars and locomotives while the merchant marine has a surplus of cargo ships. Government regulations preventing the railroads from earning adequate returns on their capital is the primary reason why the railroads have not expanded sufficiently to take care of increased production. Lack of Governmental protection against the international competition of cheap wages and cheap building costs has been the cause of our marine troubles.

In both cases these short-sighted policies are causing enormous losses. Commissioner Plummer, of the United States Shipping Board, in an address before the Convention of Industrial Engineers on October 18 said, "the fact that the grain producers of Nebraska and Iowa alone within the last month lost one hundred and fifty millions of dollars for the reason that there has been a complete breakdown of transportation, due to the starvation of our railroads for several years, shows why the people of the Middle West have a special interest in securing adequate transportation for their products." It does not seem possible that there will be a lack of ships for some time to come but it is only a short time since our farmers and business men lost hundreds of millions of dollars because there were neither foreign or American ships to take their goods.

However, there are many ways in which a prosperous merchant marine could save us vast sums today. Mr. Plummer stated in his address that 68 percent of the import and export business passing through Vancouver, B. C., last year was American. What a loss this was to the American railroads passing through the Middle West!

Indeed, both American rail and water transportation bear a vital relation to our business prosperity. And they should be co-ordinated so there will be no necks of the bottle in the future where railroad cars are backed up in the freight yards waiting for an opportunity to get their contents aboard ship. A subsidy is needed to place American ships in a position efficiently to serve the railroads and the country but foreign lines will pay for that subsidy in loss of business. It will take time for the railroads to catch up with their equipment but a close co-operation with American shipping would mean a material increase in efficiency through expedition in handling cars at seaport terminals and in other ways.

The Shipbuilding Outlook

IF the statistics of the past are any indication of what the future has in store, then the prospects are good for a renewal of activity in the shipbuilding industry. Whether the United States receives its share of the new tonnage is another matter and of course depends largely on the shipping policies adopted by this Government.

From a summary of the age and size of steam and motor vessels from the 1922-23 edition of Lloyd's Register Book, we are informed that there are 61,342,952 gross tons of steam and motor vessels of 100 gross tons and over in the world today. This compares, according to the figures of the Bureau of Navigation, Department of Commerce, with 45,403,877 gross tons of steam and motor vessels of 100 gross tons and over existing in the year 1914.

Returning to Lloyd's Register Book we find that 7,068,449 gross tons of existing shipping are over 25 years old and 5,888,923 gross tons are over 20 years old. As 20 years is considered the period of useful life for a ship, 12,957,372 gross tons of ships are now due for the shipbreaker. Added to this, by admission of the Shipping Board, at least, 3,000,000 gross tons of the American vessels built during the war are not efficient and should be scrapped. Next, for the purpose of comparison with 1914, we must remove at least 3,500,000 of the existing 4,806,400 gross tons of oil tankers as this class of vessel is the result of the development of oil for fuel. Removing these 19,457,372 gross tons from 61,342,952 gross tons leaves 41,885,580 gross tons today as compared with 45,403,877 gross tons in 1914.

Now Secretary Hoover recently stated that the world's commerce doubles every 15 years. The value of our foreign commerce in 1907 was $3,315,272,503, and last year, in spite of the depression, it was $6,994,178,926. English shipyards are experiencing a marked revival in new contracts and we may be sure that our maritime rivals are planning for the future. It is our opinion that the world commerce will more than double during the next 15 years and in such places as China, South America and Africa an even greater increase is probable. Are we going to get our share of this business?

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The A B C of the National Shipping Bill

Common Sense Answers to Pertinent Questions Concerning the Proposed Shipping Legislation

By C. A. McAllister

Q. What is a subsidy?

A. Standard Dictionary says: "Pecuniary aid directly granted by Government to an individual or commercial enterprise deemed productive of public benefit.

"Synonyms: Aid, allowance, bonus, bounty, gift, grant, indemnity, pension, premium, reward, support, etc.

"Illustration: A nation grants a *subsidy* to an ally, pays a *tribute* to a conqueror."

The authors of this dictionary could not have expressed the present situation in shipping in better terms. Unless we pay a *subsidy* to our own ally (American ships in the foreign trade) we will have to pay a *tribute* to our (commercial) conquerors.

Q. Should the pending bill be called a "Subsidy Bill"?

A. Yes, if we stick to the dictionary definition as we should, but in the minds of many prejudiced people the term "Subsidy" is taken as synonymous with some subtle kind of graft, or the giving to shipowners of something they do not earn. A better term would be a payment to shipowners as a "Retaining Fee" for keeping their vessels ready for instant use in the national defense, and to use them in times of peace to market our surplus products abroad.

Q. If foreign ships can and will carry our products cheaper than we can carry them, why not let them do it?

A. There is every reason why we should not do so, the principal of which are:

(*a*) We must sell our surplus products of the farm, mine and factory in the same competitive markets in which the owners of the foreign ships are trying to sell similar surplus products of their own. A swell chance we will have to sell our goods from our rivals' delivery wagons!

(*b*) Every merchant ship we have under our own flag is needed for our national defense in time of war. In a world wide war such as we have just emerged from, and which may happen at any time again, if we had only fighting ships upon which to depend, we would be as impotent as fire engines without hose connections to hydrants trying to fight a conflagration.

(*c*) Abraham Lincoln once said in defense of the principles of protection: "If I buy a pair of trousers abroad for $10, I have the trousers and they have my $10; if I buy them at home for $12, I have the trousers and we have the $12 at home." The same reasoning applies to our owning ships: We have the ships and keep the freight money they earn in our own pockets.

Q. How long will we have to subsidize ships?

A. In all probability, within ten years we will have learned the shipping business and applied American talents and methods to the problem, so that at the end of that period our merchant marine can look after itself. Just remember that when we started to manufacture steel, now one of the greatest of our industries, our mills could not compete with foreign manufacturers any better than our ships, now unaided, can compete with foreign ships. By a wise system of protective measures during its infancy, the American steel industry now leads the world and brings millions of dollars of reserve to our people. Many others of our leading industries have been built up in the same manner. Had it not been for the wide vision and constructive attitude of our statesmen in the past generations, America today would have been purely an agricultural country and not the leading manufacturing and commercial country of the world. Let the present generation of statesmen prepare for continued prosperity by enacting this most essential legislation to make permanent an efficient merchant marine under our own flag.

Q. Cannot American ingenuity overcome our handicaps in shipping?

A. That is an entirely mistaken assumption, based on our national self-conceit. In the foreign shipping business we are, as yet, but novices and have much to learn. Other nations have inventive geniuses as well as we.

The greatest modern invention looking towards economical propulsion of ships is the Diesel engine, invented by a German. Other nations have made vast strides in adopting this engine, while we have just started. Unless the industry is protected in its infancy by our Government, as all other nations have done for their start in shipping, we cannot be counted among contenders for our own overseas trade. After a reasonable period of protection, say ten years, it is quite probable that American methods and inventions may, by that time, have given us sufficient shipping experience and resourcefulness to keep in the contest unaided.

Q. Why are ships of such great importance anyhow?

A. In the beginning according to Biblical history and scientific deduction the entire surface of the globe was covered with water. Today over two-thirds of the surface is water. The land is divided up among some 17,000 islands, more or less, as continents are merely overgrown islands. The human race, ever restless, wanders from land to land and exchanges commodities in order to live. Hence since the beginning of the earth's habitation ships have been one of the most important factors in the development of the human race, and will continue so to be, unless aviation develops to such an extent as to replace water navigation. Even at that, aircraft are but ships in another form. Without ships America would never have been discovered and settled, so the very existence of this country is due to shipping.

Q. What interest has the farmer in shipping?

A. More, perhaps, than any other branch of industry. In the first place we produce fifteen percent more goods in this country than we can ourselves consume. Unless we have our own ships to dispose of this surplusage of the farm, mine and factory the country cannot, as a whole, be prosperous. Foreign ships will not aid us in finding markets for our exports. Unless the country at large is in a prosperous condition the farmer cannot sell in our own country at prices which will pay him to raise food products for a people whose buying is restricted to absolute necessities to maintain life.

From 1914 to 1916, the first years of the Great War, the farmers could not get their cotton, wheat, beef, pork and corn out of the country, although the demand was great, because we had no ships of our own and the merchant vessels of the countries we had been depending upon for ocean transportation were either too busily engaged by their own

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Governments or were afraid to take the risk of being captured by the enemy. The result was that all our seaports were congested with vast quantities of farm products and the men who raised them could not get their money although sales had been made.

If we are put out of the overseas shipping business, foreign vessels can make the rates so high as to debar the products of our farms, until all available wheat, cotton, etc., from competing countries have been sold. In the past summer, when the nation-wide coal strike had forced us to buy thousands of tons of coal abroad, the freight rates on that indispensable commodity started to soar. We had many ships laid up, and as soon as a number of them were put into the coal business, the freight rates immediately dropped.

Suppose we had had no ships of our own, what would have happened? Let the farmer apply this condition to his wheat, corn, pork, beef and other products.

Q. Will not this proposed legislation benefit only the shipping trust?

A. An American shipping trust exists only in the brain of the cracker-box orator and his kind. There are about 1,500 ships under the American flag (of over 1,500 tons burthen), which could be used in our foreign trade. Of these, the Government itself owns over 80 percent. The remainder are distributed among 72 firms and many individual owners, the largest single privately owned fleet consisting of 53 vessels.

Competition is so keen among these ships and with foreign ships, that the laws of the United States recognize and permit conferences to be made, in order to stop rate cutting to such an extent as to cause financial ruin to the shipowners engaged in certain trades.

In the American shipbuilding industry competition is now, and has been for many years (excluding the four year war period) so keen that many yards have been forced into bankruptcy. Many more will follow unless the Government aids shipping. Without ships and shipbuilding facilities this country will be on an island, depending on the ships of our commercial rivals for ingress and egress. If the time comes when we must defend ourselves from foreign aggression, we will be as helpless as a lion without teeth or claws.

Q. Will not the cost of this subsidy bill be a great burden on the taxpayers?

A. Positively it will not; on the contrary, it will save money to the taxpayers, for the following reasons:

(*a*) The pending measure only provides subsidies for a period of ten years. For the first year the cost will only be $15,000,000. The average cost for the entire period will not be over $40,000,000 per annum, according to expert testimony.

(*b*) We are now spending at the rate of $50,000,000 per annum to operate the Shipping Board fleet, which is found absolutely necessary to carry on our foreign trade and to prevent exorbitant freight rates being levied on us by foreign carriers. Almost all this sum will be saved by selling the ships to private operators.

(*c*) We now have over 10,000,000 tons of ships in the possession of the Government, as a direct salvage from the Great War. As private owners cannot operate them successfully, there is but little demand for them and they are laid up. Vessels not used, no matter how well cared for, rapidly deteriorate. Some are being sold at ridiculously low prices, because that is now the only way they can be sold. The recent sales of Government-owned ships do not average much over $10 per ton. If this bill is passed, and private owners can operate the ships successfully by means of its benefits, the sale value for the remainder of the Government fleet will advance rapidly. This enhancement of value alone should more than offset the entire ten years' cost of the subsidy, so it is plainly to be seen that the taxpayer will be directly benefitted by a reduction instead of an increase in his taxes.

Indirectly he will be greatly benefitted by the increased sales of our goods in foreign markets, and the general prosperity which such will bring. For example, the leading Shipping Board line to South America, while being operated at a comparatively small loss, succeeded in increasing its trade to the ports at which its vessels touch 107 percent in one year. All branches of our industries benefit by such an increase, directly or indirectly.

Q. Why does it cost more to operate ships under the American flag than under foreign flags?

A. Simply because Americans in every walk of life are accustomed to, and demand, higher standards of living, more comforts and more luxuries than the people of any other nation under the sun. Every industry and profession in this country is protected, either by a tariff or by over 3,000 miles of sea, except our shipping engaged in the foreign trade. The latter must meet the fiercest competition from the shipping of all other maritime nations, as soon as our vessels leave our ports. You cannot expect Americans to build our ships and work at the same rate of wages paid in foreign shipyards, nor can you expect our citizens to go to sea and operate our ships at the same rates of pay fixed by lower standards of living in foreign countries and paid to the men on foreign ships. Experts have conclusively demonstrated that under normal conditions the workmen in American shipyards and the crews on American ships must be paid 25 percent higher remuneration than men similarly employed in building and manning foreign ships. With a tariff on all competitive commodities, and immigration restrictions on all branches of the labor market, would it be fair to make our men in the shipyards and on our ships work without protection of some kind from their government? Our forebears all came to this country because of the greater opportunities and better living conditions in this country. Why not keep up the standards established here in the only branch of industry not now protected in some direct or indirect manner?

Q. If we amend and modernize our navigation laws, will not our ships then be able to compete for the ocean trade?

A. Such a procedure will help, as certain portions of the laws and regulations do need to be amended. It has been proposed that we adopt the Merchant Shipping Act of Great Britain in its entirety, so that our ships would be as little restricted and hampered as English ships are reputed to be. Even if we did that, helpful as it might be, American ships could not compete with British ships. In reality, although there has been much oratory and many editorials expended in railing against our so-called "moth-eaten" navigation laws, they are not nearly so bad as we have been led to think. Three years ago a committee of expert shipping men appointed by the Shipping Board spent several months in studying the various laws relating to ships and found but a few changes to be necessary. The laws are now being re-codified in consonance with that committee's recommendation and will soon be presented to Congress for its action.

The much discussed and condemned Seaman's Act was found to need amendment in but a few respects, to make it entirely acceptable to these practical shipping men. As a noteworthy example of the findings of this committee, it is but necessary to consider the heretofore almost universally accepted idea, that American ships were greatly handicapped by discriminations in regard to the net tonnage, assigned by our Government officials, being noticeably in excess of the net tonnage assigned by the British government to vessels of the same type and dimensions. If such were the fact, our vessels would have had to pay heavier taxes, canal tolls, port charges, etc. The Navigation Laws Revision Com-

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mittee, however, found that no discriminations existed, and so reported to the Shipping Board.

Revision of our navigation laws will help in an indirect way but will be entirely inadequate to keep our ships on the seas without some direct financial help such as carried in the legislation now pending.

Q. Does not partisan politics enter into this proposed legislation?

A. If there is any one policy before the American public in which partisan bias does not enter, it is in regard to our shipping. Both the great political parties in their platforms for many years past have gone on record as favoring the rehabilitation of our merchant marine. There are, naturally, differences of opinion as to how this best can be done. Many statesmen have advocated discriminating import duties as the best solution, and in fact such a policy is now the law of the land, but both former President Wilson and President Harding are of the opinion that such policy is inadvisable because of certain treaties now extant, hence that law has not been enforced. Many people are still firmly of the opinion that the existing law would solve the problem, but there is no hope of its being enforced. In consequence the pending subsidy bill appears to be the only practicable solution. As both political parties are pledged to the upbuilding of our merchant marine, they should unite in support of what is apparently the only policy which is workable. Democrats should not forget that Thomas Jefferson, the founder of their party, was the most pronounced advocate of a strong American merchant marine. If he were alive today, it is more than probable that he would advocate the pending bill in view of the circumstances now existing. Republicans should bear in mind that their great leaders, McKinley and Roosevelt, were staunch advocates of subsidies as the best method of building up the merchant marine. Wilson and McAdoo are responsible for the existence of the great fleet of vessels we now own. To show the non-partisanship of the present measure, it is only necessary to call attention to the fact that its leading proponents in the Senate today are Senator Ransdell, a Southern Democrat, and Senator Jones, a Western Republican.

President Harding, formerly a senator from an interior state, where there is no direct interest in ship ownership, is and has been one of the staunchest advocates of the upbuilding of our foreign trade through the medium of American ships; thereby showing broad and statesmanlike vision. Grosvenor and Hanna, leaders in previous attempts to pass similar legislation, were both from Ohio, which shows that shipping is not an issue belonging to the people along our coasts, but a vital national necessity.

Q. How will the shipping bill benefit labor?

A. The creation of a permanent and efficient merchant marine by means of the Subsidy Act, will furnish additional employment to over 100,000 Americans on board ship, in the shipyards, the steel mills, the iron mines, and in the many other industries which are necessary to build and operate ships for the foreign trade. Every man thus employed must be well fed, and the American farmer will be benefited by raising and selling the food to them and their families.

Q. Why did the Washington Conference make the shipping bill imperative?

A. Without this encouragement to our merchant marine, we will build no more ships. We have, by international agreement, already stopped the building of fighting vessels. Hence, without any work to do, shipbuilding will become, in America, a lost art. Without shipbuilders and shipbuilding facilities this nation will be helpless for both commerce and for self-defense—an emasculated giant in the family of nations.

Q. What do our maritime rivals think of the shipping bill?

A. Our rivals for the world's trade view with great alarm the prospects of the passage of this bill, and their emissaries masquerading, in many instances, as patriotic citizens are spreading insidious propaganda and doing their utmost to defeat the measure. This is the strongest evidence possible why the bill will benefit America, and why it should receive the support of patriotic Americans.

Fuel Conservation Committee Starts Fuel Oil School for Marine Engineers

IN line with the efficiency of operation and fuel conservation program instituted by Vice-President Jos. E. Sheedy of the United States Shipping Board, and which is being promulgated by the Fuel Conservation Committee of the Shipping Board, headed by Captain C. A. McAllister, and including in its members Commander R. D. Gatewood, Mr. E. H. Peabody, Major G. M. Talbot, Mr. D. M. Myers, Mr. Maurice Healey and Mr. F. B. Webster, an offer made by Secretary Denby of the United States Navy to the Shipping Board that a school of instruction in fuel oil burning by the Navy Department be established for the benefit of the officers of the Merchant Marine has been accepted and the school started on October 23.

Licensed American marine engineers of the grade of second assistant or higher on active duty are eligible for the course. The course is intensive, as indicated in the schedule below:

		FIRST DAY	
9	to 10	a. m.	Lecture on oil characteristics.
10	to 11	a. m.	Lecture on curves.
11	to 12	a. m.	Inspection of testing plant.
1	to 2.30	p. m.	Lecture on specific gravity, baume, hydrometer, viscosity, moisture and sediment, flash and fire points.
2.30	to 4	p. m.	Demonstration in laboratory of above features.
		SECOND DAY	
9	to 10	a. m.	Safety precautions.
10	to 12	a. m.	Lecture on combustion—Orsat, draft gauge, pyrometer.
1	to 4	p. m.	Laboratory—operation of Orsat, draft gauge, pyrometer, interpretation of CO_2 curves and excess air.
		THIRD DAY	
9	to 10	a. m.	Lecture on atomization—cleaning tips, atomizers.
10	to 12	a. m.	Demonstration of spray with tip testing apparatus, and in boiler.
1	to 4	p. m.	Laboratory work—relation of flame colors, smoke, and gas analysis.
		FOURTH DAY	
9	to 10.30	a. m.	Lecture on refractories and insulations.
10.30	to 12	a. m.	Demonstration of test furnaces.
1	to 4	p. m.	Laboratory work installing brickwork and plastic.
		FIFTH DAY	
9	to 10	a. m.	Lecture on water testing outfit and water treatment.
10	to 12	a. m.	Laboratory use of water testing outfit.
1	to 2	p. m.	Summary lecture by commanding officer of fuel oil testing plant and school.
2	to 4	p. m.	Examination.

The United States Navy, in conjunction with the Fuel Conservation Section of the Shipping Board, will conduct the course, which will be directed by Lieutenant Commander E. R. Norton. The lectures will be given by officers of the Navy and technical aides who have demonstrated the successful methods of operation on naval vessels which have made our ships the most efficient of any oil-burning vessels afloat.

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Graduated Compensation of Shipping Bill Explained

Mail and Passenger Ships Receive More Than Cargo Ships Because They Cost More to Construct and Operate

By Winthrop L. Marvin*

A SUMMARY of the provisions of the National Shipping Bill, such as was contained in the October issue of MARINE ENGINEERING AND SHIPPING AGE, may logically be followed by a statement of the reasons justifying National aid, first to the cargo ships and second to the passenger, mail and cargo liners that together constitute a balanced merchant marine.

First of all, the mileage-tonnage compensation provided for cargo ships of a speed of 11 knots and less is intended by the government officials to constitute an approximate offset to the lower wages of officers and men and the lower cost of subsistence on shipboard of our principal foreign competitors, who are the shipowners of Great Britain, possessing as they do nearly one-half of the active overseas shipping tonnage of the world.

A series of careful estimates based upon actual ship pay-rolls, prepared by the United States Shipping Board and confirmed by the records of private American shipowners, goes to show that the basic compensation of one-half of one cent for each gross ton of a vessel for each one hundred nautical miles covered by the vessel in the foreign trade of the United States represents approximately the difference between the wage and food cost of a representative American ship and of a representative British ship of the same type and capacity.

Following are tabular comparisons of the wage scales of representative American and British steamers of a good average size, or 6,000 tons gross register, both engaged in North Atlantic commerce:

COMPARISON OF AMERICAN AND BRITISH PAY-ROLLS.

	American Scale (Privately-Owned-Ship) Per Month	British Scale Per Month
Master	$275	£45 0 0
Mate	165	20 10 0
Second Mate	140	16 0 0
Third Mate	125	13 0 0
Carpenter	70	12 10 0
Boatswain	..	11 10 0
Able Seamen (6)	285	60 0 0
Ordinary Seamen (2)	70	11 0 0
Chief Engineer	250	24 10 0
Second Engineer	165	20 10 0
Third Engineer	140	16 0 0
Fourth Engineer	125	13 0 0
Deck Engineer	70	11 10 0
Oilers (3)	165	33 0 0
Firemen (9)	450	94 10 0
Coalpassers (3)	120	30 0 0
Steward	105	14 10 0
Cook	90	13 10 0
Second Cook	70	9 10 0
Messboys (3)	90	8 10 0
Radio	90	13 10 0
	$3,060	£492 0 0
Pound sterling converted @ $4.43		$2,179.56
American scale		$ 3,060.00
British scale, present exchange, $4.43=£1		2,179.56
Difference		880.44
Subsistence difference		240.00
Total monthly difference		$ 1,120.44

*Vice-president and general manager, American Steamship Owners' Association.

Annual difference for 11 months at present rate of exchange $12,324.84

Compensation, as proposed, 6,000 tons gross × $0.005 = $30.
Allow 35,000 miles per year = $10,500 annual compensation for this type.

These wage scales respectively embody the standard rates in practice at the present time on American and on British cargo steamers, with white crews. It is made clear that the American steamer, considering both wage and subsistence costs, is at a disadvantage of $1,120.44 per month, or of $12,324.84 for eleven months, as compared with its British competitor. According to the best available estimates, the 6,000-ton American steamer, on a basis of a subsidy of one-half of one cent for each gross ton for each one hundred nautical miles traveled in the foreign trade, will earn a total compensation or subsidy in eleven months of $10,500. This subsidy of itself falls somewhat short of meeting the higher wages and subsistence of the American ship, so that the indirect aids in the National Shipping Bill must be depended on for the exact equalizing of conditions between American and British cargo steamers of like type and tonnage. It is obvious from these facts as given that, so far as the compensation or subsidy is concerned, not a dollar of it can rightfully be regarded as a bonus for the shipowner. Every dollar of this compensation goes into the pockets of the American officers and seamen, who are the direct beneficiaries of the proposed legislation.

COMPETITIVE CONDITIONS MAKE COMPENSATION NECESSARY

It may be urged that American shipowners are now operating steamers in the foreign trade, and are paying out of their own pockets the difference between American and British wages and subsistence. So they are, but nothing is more unmistakable than that they cannot and will not continue so to do, any more than they were operating ships and paying higher wage and subsistence costs before the world war, when, as is generally known, the American flag, except as borne on a certain few subsidized mail routes, had virtually left the ocean, and more than nine-tenths of our export and import trade was being conveyed by the ships of foreign nations. What was once will most certainly be again, unless the full compensation proposed in the National Shipping Bill, to even up competitive conditions and give American ships a fair chance, is promptly and fully made available. If the proposed compensation is not given, experience demonstrates that American cargo ships will be forced out of overseas trade, and their officers and men will cease to exist as seafarers.

There is agreement among an overwhelming majority of the American people of both political parties that the tariff laws of the United States shall be so adjusted as to give American labor a fair chance against competing foreign labor in manufacturing and in agriculture. Can any man who calls himself an American give a reason why there should not be equivalent fair play for our labor on the sea?

INCREASED COMPENSATION REQUIRED FOR FASTER SHIPS

For passenger, mail and cargo steamers operating on regular lines, and generally of a speed of from 12 knots upward, graduated, increasing rates of compensation or subsidy are

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provided by Section 404 of the National Shipping Bill. For ordinary cargo steamers of 11 knots and less, generally described as of the "tramp" class, though running on regular routes, the rate of compensation, as has been said, is one-half of one cent for each gross ton for each one hundred nautical miles traversed in the foreign trade. The 12-knot steamer, the lowest speed that is likely to be employed in the passenger, mail and cargo service, is given by the Shipping Bill an additional compensation of one-tenth of one cent, if her speed is 12 knots or less than 13 knots; of two-tenths of one cent, if her speed is 13 knots and less than 14 knots—and so on upward until an additional compensation of two and one-tenth cents per gross ton for one hundred nautical miles sailed is provided for steamers of a speed of 23 knots or more—or a total compensation for such ships of two and six-tenths cents per gross ton for each one hundred miles covered.

The reasons for this graduated increase of compensation to the faster ships are that these faster steamers invariably cost more money to build and operate and, therefore, involve a very great increase in capital investment. A Senator, criticising the terms of the National Shipping Bill, recently asked why a 10,000-ton cargo steamer should receive compensation of only $15,000 a year, while the *Leviathan* would receive $900,000.

Compensation for Leviathan Analysed

This is an extreme comparison. There are many 10,000-ton cargo steamers, but there is only one *Leviathan* under the American flag. Ten thousand-ton cargo steamers were being built in American yards before the world war for from $60 to $65 per deadweight ton. Such ships during the war, because of the emergency, and soaring prices of materials and wages, cost as high as $200 per deadweight ton. But 10,000-ton cargo steamers are being sold in all countries now at an average price of $30 per ton. It is understood that the *Leviathan* originally cost in Germany before the world war about $7,000,000 to construct, and approximately $8,000,000 is now being expended for the reconditioning of this mighty steamer.

Considering further, that the 10,000-ton cargo steamer can be navigated by 35 men, while the *Leviathan* has required a crew of 1,000 men—and considering the difference in the cost of stores and fuel which the cargo ship and the *Leviathan* will consume, it is manifest that the 10,000-ton cargo steamer is not over-compensated nor is the *Leviathan* over-compensated, though the latter ship may receive $900,000 a year. The British government, it should be remembered, gave a subsidy to the Cunard Line in 1903 of about $1,050,000 a year for the two ships *Mauretania* and *Lusitania,* after having lent, at the low interest rate of 2¾ percent, about $12,000,000 for the construction of the two steamers. The *Mauretania* is of 30,000 tons gross register. The *Lusitania* was of 30,000 tons gross register. The *Leviathan* is of 54,000 tons gross register. If the *Leviathan* receives a compensation or subsidy of $900,000, or $16.67 per gross ton per year, it will be not dissimilar from the total annual subsidy of $17.50 per ton per year which the British government gave under a twenty-year contract to the *Mauretania* and *Lusitania.*

All Maritime Nations Have Aided Establishment of Passenger Lines

All maritime governments in the world have found it necessary in the last eighty years to pay considerable sums of money to create and to maintain their National lines of passenger, mail and cargo steamers. Great Britain was the pioneer in this subvention or subsidy policy, beginning with the founding of the Cunard Line in 1839, with a subsidy of $425,000 a year. There is not the slightest reason to believe that the United States can create and maintain essential National lines of passenger, mail and cargo steamers in any other way than that pursued by Great Britain, France, Germany, Japan, Italy, Spain or any other nation that has owned or owns fleets of express ocean steamers. Historically, all such large, fast vessels of the naval reserve have been subsidized, or if not subsidized have received equivalent compensation. This is the purpose of the paragraphs of Section 404 of our National Shipping Bill, which provide graduated increasing rates of compensation for regular passenger, mail and cargo services of a speed of from 12 knots to 23 knots and upward. The problem is different from the problem of the cargo ships pure and simple, where the compensation provided is only enough to cover the difference in wage and subsistence costs between like American and foreign vessels.

Liners under all flags and in all times have demanded special consideration from their governments. The cost of constructing and operating steamers of more than ordinary commercial speed fitted for mail and passenger service is such that these fast services have under no flag been able to succeed without very generous National assistance. Cargo steamers of from 9 to 11 knots, out of the excess of tonnage built during the world war, are now being sold in all countries for an average of $30 per deadweight ton. Passenger, mail and cargo steamers of more than usual commercial speed would cost, if now constructed, all the way from five to upwards of ten times as much per ton, and would cost correspondingly to maintain and operate. These are substantially the main reasons why the rates of compensation provided for liners in the National Shipping Bill are higher than for 9 to 11-knot cargo or "tramp" steamers.

The United States Shipping Board has a small fleet of existing mail, passenger and cargo steamers for sale, but the cost of these, if they are relatively new ships, has been the equivalent of many times $30 per deadweight ton. And as to the older German ships, the cost of these also will prove exceedingly high when they have been properly reconditioned for liner service.

New Tariff Rates in Ceylon

CONSUL VANCE, Colombo, cables the Department of Commerce that the new customs tariff of Ceylon which went into effect provisionally from August 25, as announced in *Commerce Reports* for September 4, has been adopted with certain modifications. The import duties on motor trucks, cotton goods and fish are to remain unchanged, while the advance on automobiles, motorcycles and soap is more moderate than had been proposed. The final rates on the more important articles of trade with the United States are as follows:

Articles	Former duties Ad valorem	New duties Ad valorem
Automobiles	7½ percent	10 percent
Motorcycles	7½ percent	10 percent
Motor trucks	7½ percent	7½ percent
Toilet soap	7½ percent	10 percent
Agricultural machinery run by other than human or animal power	Free	2½ percent
Cotton goods	5½ percent	5½ percent
Fish, dried or salted, per hundredweight	Rupees 0.75	Rupees 0.75
Meat, frozen or refrigerated	Free	2½ percent Ad valorem
Paper machinery	Free	2½ percent
Articles not specified	Ad valorem 7½ percent	Ad valorem 10 percent

The proposed advance in the export duty on tea grown on the island has been increased from 1½ Ceylon cents to 3 cents per pound.

The duties in Ceylon apply equally to imports from all sources.

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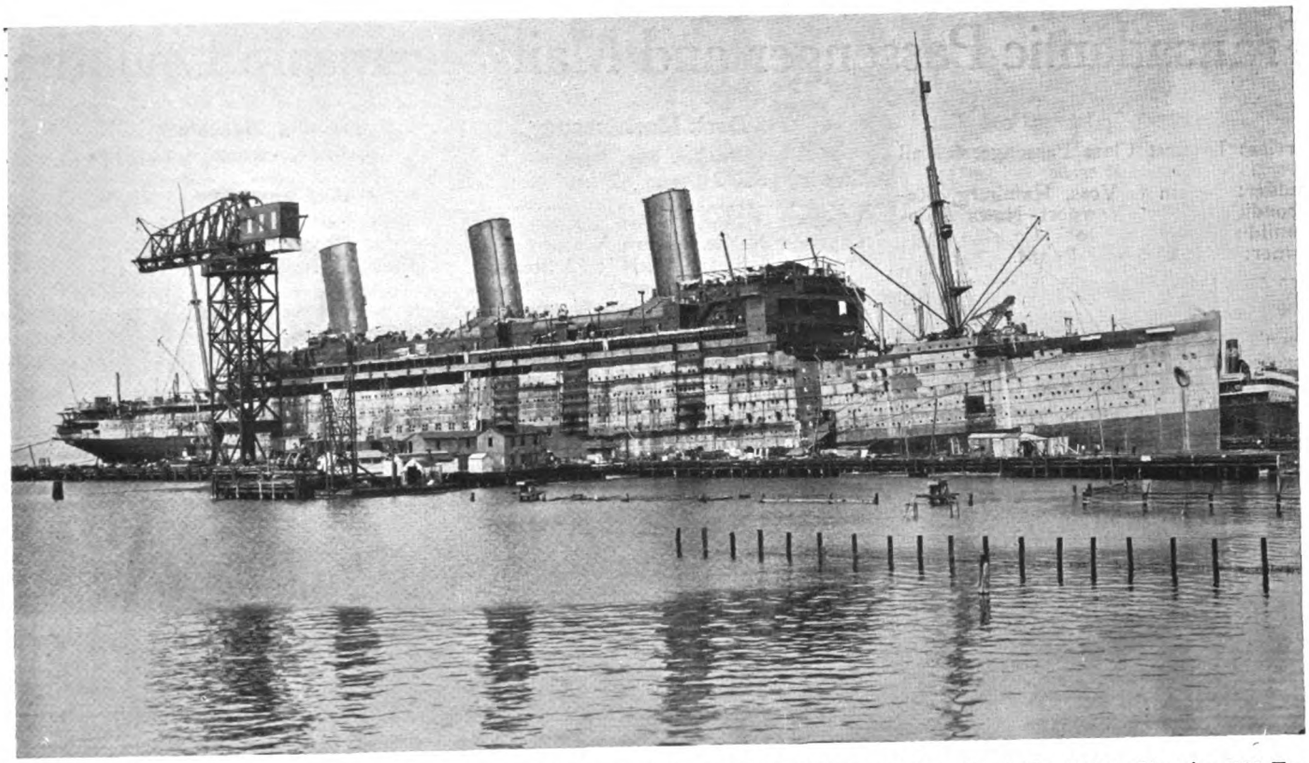

View of Steamship Leviathan at Fitting Out Pier of Newport News Shipbuilding and Dry Dock Company, Showing 120-Ton Hammer Head Crane on the Pier for Placing Heavy Equipment on the Vessel. Hanging Scaffolding Can Also Be Seen Along the Side of the Vessel Used in Scraping and Painting the Topsides of the Hull

The Reconditioning of the Steamship Leviathan

Newport News Shipbuilding and Dry Dock Company Converting the World's Second Largest Vessel Into the Finest Transatlantic Liner Afloat

WHEN the proposal to recondition the *Leviathan* as a first class passenger liner was under consideration after the vessel had completed her service as an army transport during the world war, the Government was confronted with a task far greater than had ever been attempted in the history of shipbuilding. When completed in Germany in 1914 the vessel was the largest liner in the world; since then she has been surpassed in size by only one other vessel, the White Star liner *Majestic,* which, except for a matter of 2,269 gross tons increase in measurement, is practically a sister ship of the *Leviathan.*

After completion, the *Leviathan* (ex-*Vaterland*) made only three voyages across the Atlantic under the German flag, as at the outbreak of the war she was interned in New York harbor where she remained until the United States entered the war in 1917 when she was seized by the Government and pressed into service as a troopship. During the two years she was used as a transport the vessel was stripped of her furnishings and all decks below the weather deck were cleared so that she could carry from 11,000 to 12,000 troops on each voyage instead of the 3,400 passengers for which she was originally designed. After going out of commission as a transport the vessel remained idle at her pier in New York harbor for a period of two years.

Plans and Specifications Required

In reconditioning the vessel for the transatlantic passenger trade, therefore, not only was the toll of her active war service, and subsequent enforced idleness, to be reckoned with but also, due to her construction abroad, plans of the hull and machinery were unavailable, except from her original owners at a prohibitive price. The first step necessary, therefore, was the preparation from the ship itself of plans and specifications for the work.

Through arrangements made by the United States Shipping Board with the International Mercantile Marine Company, New York, this work was successfully carried out under the supervision of William F. Gibbs, chief of construction of that company. In accordance with these plans and specifications contracts were awarded by the United States Shipping Board, Emergency Fleet Corporation on February 15, 1922, to the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., for reconditioning and conversion of the vessel to an oil burner and for repairs and machinery; also to Gimbel Brothers, New York, for the equipment of the steward's department and for a library, and to Gibbs Brothers, Inc., engineers, New York, for the supervision of the work.

Cost of the Work

The cost of placing the *Leviathan* in commission in accordance with these plans will be approximately $8,200,000, distributed as follows:

Newport News Shipbuilding and Dry Dock Company

Reconditioning and conversion to an oil burner	$5,595,000
Repairs and machinery	515,000

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Transatlantic Passenger and Mail Steamship Leviathan

General Information

Service: Highest Class Passenger & Mail service, transatlantic trade.
Builder: Blohm & Voss, Hamburg. Reconditioned by Newport News Shipbuilding and Dry Dock Co.
Owner: U. S. Shipping Board.

Characteristics

Length, overall	949′ 9″
Length, B. P.	928′ 5″
Breadth, molded	100′ 0″
Depth, molded to D. Dk.	70′ 4¼″
Draft, loaded, about	40′ 0″
Block coefficient	0.625
Draft, light	
Midship section coefficient	
Longitudinal coefficient	
Speed, loaded, knots	
Cruising radius, nautical miles	
Framing	Transverse
Class	American Bureau of Shipping

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	
**Weight Propelling Machinery	
Deadweight Capacity	
Displacement	66,800

(In tons of 100 cubic feet)

Gross register, about	56,940
Net register, about	28,000

* Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.
** Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

Anchors, 1 12-ton Stockless, Bow; 2 10-ton Stockless, Bow.

Chain, 165 Fath. 4⅛″ Stud Link; 165 Fath. 3⅞″ Stud Link; 150 Fath. 3 3/16 Stud Link.

Rudder

Area, 409 sq. ft. Balanced Type.
Dia. Stock, 32″.
C. Press, abaft C. L. pintles.

Complement

Deck officers	15
Deck crew	135
Engineer officers	46
Engineer crew	226
Purser's and steward's department	693
Total officers and crew	1,115
First-class passengers	976
Second-class passengers	542
Third-class passengers	944
Fourth-class passengers	936
Total passengers	3,398
Total complement	4,513

Handling Equipment

	No.	Type	Capacity	Length
Masts	2			213′
Derrick posts	4	with boom	3 ton	52′-72′
Booms	5		6 ton	
Booms	5		3 ton	
Discharg'g Cap.				

Deck Machinery

(Number, Size, Type)

Steering gear, 2 Steam, 17″x10″

Windlass, 3 Bow, 1 Stern, Battleship Type.
Capstans, 2 Bow, 2 Stern, Warping Engine.
Winches, 6 Steam, 8″x14″; 12 Steam, 7″x 12″; 1 Electric (10 tons).

Life Saving Equipment

Lifeboats	No.	Type	Length
Lifeboats	60	....	30′
Lifeboats	8	....	26′
Motorboats	2	....	30′
Workboats	2	....	22′

Propelling Machinery

Boilers

Number	46
Type	Modified Yarrow
Length	
Width or Diameter	
Furnaces	
Fuel	Oil
Draft	Natural
Total heating surface, sq. ft.	179,768
Total furnace volume, cu. ft.	24,150
Superheat, degrees F.	None
Working pressure, lbs. per sq. in.	248
Normal fuel consumption:	
Per day, tons	
Per horsepower hour, pounds	
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Number	Direct Connected Turbines
Type	Parsons Reaction
Size	
Horsepower	60,000

Propellers

Number	4
Type	Solid 4-bladed bronze
Weight	
Diameter	16′ 6″
Pitch	
R. P. M.	
Projected area	
Developed area	

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers 4

Weir type, 66,564 sq. ft.

Evaporators	6
Distillers	2
Filters	4
Feed water heaters	4
Fuel oil heaters	16
Pumps	
16 Main feed	
4 Aux. feed	
4 Ballast	
6 Bilge	
8 Lub. oil	
4 Weir dual air pumps	
2 Aux. air pumps	
2 Main circ. pumps	
2 Aux. circ. pumps	
6 Fire and san. pumps	
4 Fuel oil transfer pumps	
10 Fuel oil service pumps	
39 Misc. pumps	

Refrigerating Machinery

3 Hor. Compound Steam Eng. Drive.

2 Aux. Motor Drive.

Electric Equipment

Turbo Generators—115 Volt.
(4) 288 K.W.; (1) 500 K.W.
Radio, Not Determined.
Emergency: 2 Batteries (1) 200 Aph., 115 Volts., (1) 600 Aph., 115 Volts.
2 Diesel Eng. Gen., each 60 K.W., 115 Volts.

Holds

No.	Length		Hatches
1	69′ 0″	No. 1	16′0″x21′
2	75′ 0″	No. 2	20′ x20′
Hatch No. 3	Baggage and Mail		16′ x12′
Hatch No. 4	Baggage and Mail		10′ x12′
Hatch No. 5	Baggage and Mail		16′ x12′
Hatch No. 6	Baggage and Mail		15′ x12′

Capacities

Cargo Space

Compartment

1 betw. H. & L. Deck, about 39,000 cu. ft.

2 betw. H. & K. Deck, about 50,000 cu. ft.

Refrigerated Space

Compartment	Cu. Ft.
Compartments for Meat, Fish, Eggs, Vegetables, Flowers, etc.	16,600

Bunkers (Fuel Oil Tanks)

Compartment	Cu. Ft.	*Tons
Inner Bottom	120,796	3,245.6
Deep Tank	144,559	3,884.2
Wing Tanks	38,984	1,047.2
Total	304,339	8,177.0
Service Tanks	51,610	1,386.6
Grand Total	355,949	9,563.6
Fore Peak (Water Ballast Only)	5,994	171.7

*....cu. ft. per ton;.....gals., per bbl.

Fresh Water Tanks

Compartment	Cu. Ft.	Tons
Inner Bottom	90,613	2,517.0
Tank No. 22	5,102	141.7
Deep Tank	7,138	198.2
Tank, K. Deck	14,031	389.7
Aft. Peak	8,267	229.6
Total	125,151	3,476.2

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GIMBEL BROTHERS	
Equipment of steward's department	546,000
GIBBS BROTHERS, INC.	
Supervision	182,000
MISCELLANEOUS	
Moving ship to contractor's yard, insurance covering removal, new anchors and chain, moving ship to dry dock, dry docking, trial trip and maintenance and guarding of ship for 14 months during reconditioning	1,352,000
Total	$8,190,000

Upon award of the contracts the vessel was moved, under the personal supervision of Mr. Gibbs, to the yard of the Newport News Shipbuilding and Dry Dock Company, orders were placed by the shipbuilders for material, some 200 contracts were placed with sub-contractors for equipment and supplies and the work, to be completed in 14 months, was begun. As an indication of the completeness and accuracy of the plans and specifications and the efficiency and skill of the contractors it is noteworthy that up to date not a single extra charge has been incurred, a condition seldom achieved with vessel reconditioning contracts of far less magnitude.

SCOPE OF THE WORK

The work involves extensive structural changes in the hull with a view to increased strength and safety, the conversion of the vessel to an oil burner, the overhaul and repair of all machinery, the new construction of all quarters below the weather or *D* deck, the reconditioning, decoration and furnishing of all passenger accommodations and crew's quarters, installation of complete new galley and pantry equipment of the most modern type, complete new and improved electric wiring, steam heating and plumbing systems throughout the ship, improved ventilation and drainage systems, changes in the engine room and fireroom ventilation to add to the safety of the vessel, and the installation of new and improved equipment of American manufacture for the safe and efficient navigation and operation of the vessel. The work is being done under special survey of the American Bureau of Shipping to meet the requirements for the highest classification of the Bureau. In general the scantlings are all in excess of the American Bureau requirements and the workmanship and materials conform in every respect to the requirements of the United States Steamboat Inspection Service.

The vessel has five steel decks extending the full length of the hull, four decks in the superstructure and additional decks in the forward and after holds. The 13 transverse watertight bulkheads, which originally extended to *F* deck, have all been tested to *F* deck and two in the forward holds have been strengthened and made watertight to *D* deck and two others, the forward collision bulkhead and the one between boiler rooms 1 and 2, have been made watertight to *E* deck. Intermediate beams have been fitted on *L*, *K* and *J* decks forward, the double bottom forward of boiler room 4 has been converted into fuel oil tanks, fuel oil deep tanks have been built in the forward holds and service oil tanks and pump rooms in the former coal bunkers alongside the boiler rooms.

Extra oil-tight bulkheads have been constructed at frames 277, 261, 253 and 236 and a centerline oil-tight bulkhead from frame 224 to 293. The scantlings of all new construction in the fuel oil tanks are in excess of the requirements of the American Bureau of Shipping for a pressure due to a head of water up to the level of *F* deck. For the fresh water tanks the scantlings are for a pressure due to a head of water up to *E* deck.

In bringing the main watertight bulkheads up to the American Bureau requirements extra local stiffening has been provided and the size of and the riveting in the heel and head brackets of the stiffeners have been increased. During the survey of the bulkheads it was found that in several instances rivets had been omitted where holes had been provided for them and in such cases new rivets were driven up.

Due to the greater subdivision of the hull forward of the engine rooms, the strengthening and extension of the bulkheads, the elimination of many of the watertight doors in the bulkheads and the rearrangement of the ventilating systems, to the engine and boiler rooms, the protection of the vessel against flooding due to collision or grounding is substantially increased. The safety of the ship is also materially increased by the addition of 9 new firescreen bulkheads making 20 in all which are installed in the passenger quarters.

PASSENGER ACCOMMODATIONS

The arrangement of the passenger accommodations is shown by the accompanying plans. Above *D* deck, the former arrangement of the rooms, including the first class public rooms and suites, will in general be retained. Below *D* deck the passenger and crew's quarters are principally of new construction.

The interior decoration and furnishing of the first and second class accommodations, under the supervision of Walker and Gillette, architects, New York, will surpass in beauty, comfort and convenience anything previously attempted in a floating hotel. The draperies are being furnished by W. and J. Sloane, New York; the carpets (about 20,000 square yards) by the Bigelow Hartford Carpet Company, New York, and Alexander Smith and Sons, New York; the Oriental rugs (about 3,000 square yards) by Costikyan and Company, New York; equipment for the first and second class gymnasiums by A. G. Spalding, Chicopee, Mass., and furniture by the Orsenigo Company, Long Island City, N. Y., Smith and Sons, New York, and Sons-Cunningham Company, New York. Large quantities of the cabinet work are being manufactured by the Newport News Shipbuilding and Dry Dock Company. Eleven new electric elevators are being installed by the Otis Elevator Company, New York, 3 for first class passengers, 1 for second class passengers, 1 for the engineers and 6 for freight, in addition to 5 new electric dumbwaiters.

On the bridge deck numerous changes are being made in the officers' quarters, due to the reduction in size of the ventilating trunks to the boiler rooms giving space for additional rooms, including among others a library for the captain's suite and a smoking room for the deck officers. Further aft on *A* deck a similar smoking room is being fitted for the engineers.

On *A* and *B* decks are the principal first class public rooms and promenade space. On *C*, *D*, *E* and *F* decks amidships are the first class staterooms, special suites and the main dining room and galleys.

The second class accommodations are on *C*, *D*, *E*, *F*, *G* and *H* decks aft of the machinery space and further aft on *D*, *E*, *F*, *G*, *H* and *J* decks are the third class accommodations while the crew and steerage quarters are forward on *D*, *E*, *F*, *G*, *H* and *J* decks.

The new flooring in general is of American Lit-O-Sil-O decking, supplied by the Marine Decking and Supply Company, New York, covered with linoleum, carpet or rugs. In the new construction about 150,000 square feet of heavy plyboard either Haskelite (56,000 square feet) or Roddiswood, supplied through the United States Plywood Company, New York, and about 100,000 square feet of Vehisote, supplied by the Pantasote Company, New York, are used.

So extensive is the work being done in the new construction, reconditioning, decoration, furnishing and fitting out of the passenger accommodations that no adequate description of it can be given in the space available at this time. This phase of the work will be dealt with in a later article when the vessel is completed.

PROPELLING MACHINERY OVERHAULED

Propulsion of the *Leviathan* is by four shafts driven by direct connected Parsons turbines arranged as follows, from

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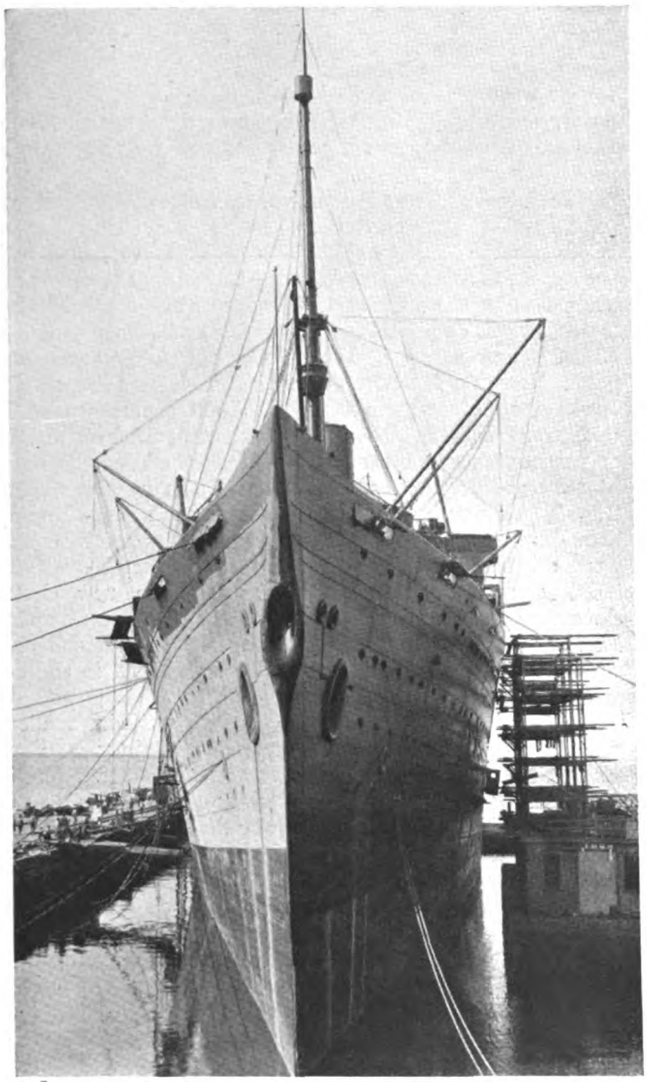
forward aft: Port inboard shaft, high pressure ahead and high pressure astern; starboard inboard shaft, high pressure astern and intermediate pressure ahead; port outboard shaft, low pressure ahead and low pressure astern; starboard outboard shaft, low pressure ahead and low pressure astern. In full speed condition steam is admitted first to the high pressure, then to the intermediate and then to the two low pressure turbines. For maneuvering, steam is admitted from the boilers direct to both the high and intermediate pressure turbines and then from the high pressure to the port low pressure and from the intermediate to the starboard low pressure turbine.



Viewed Head-On at Her Fitting Out Berth the Leviathan, in Spite of Her Enormous Size, Has the Appearance of a Swift Yacht or Destroyer

On the maneuvering board in the operating room are valves by which, in the event of the breakdown of any shaft, a change can be made to the other shafts in 3 or 4 minutes. In this way a major breakdown to the machinery could occur without affecting the safety of the vessel or her passengers in the slightest degree.

In reconditioning the ship the main turbines and all of the auxiliary machinery, fittings and equipment are being thoroughly overhauled and put in first class condition.

Boilers Converted from Coal to Oil Burning

Steam is furnished at 248 pounds per square inch by 46 Yarrow type watertube boilers located in 4 boiler rooms and the boilers are being converted from coal to oil burning. The finished installation is guaranteed to burn from 500 to 2,240 pounds of Mexican crude oil of 10.6 to 10.8 degrees Beaume having a viscosity of 6,000 Saybolt seconds at 150 degrees F. per boiler per hour under service conditions. The original coal burning equipment will be retained for possible reconversion at some future time should this become desirable.

The oil burners at the boilers, of which 5 are fitted to each boiler, are of the Peabody type supplied by the Peabody Engineering Corporation, New York.

To provide a total fuel oil capacity of about 9,563 tons of 11 degree Beaume Mexican fuel oil with the tanks 97 percent filled the following tanks will be used: 25 double bottom tanks, 13 deep tanks and 8 service tanks, all provided with connections for filling. The double bottom fuel oil tanks are all forward of frame 150 at the forward end of boiler room No. 4, where a cofferdam is built to isolate the fresh water tanks aft. The deep tanks are located in holds 1, 2 and 3 forward of No. 1 boiler room and extend up to *L*, *K* and *J* decks, respectively. The service tanks are located in the former side coal bunkers, 2 in each boiler room, 1 on either side, extending from the tank top to *J* deck, except in boiler room 4, where a cofferdam is built above the tank top to isolate the service tanks from the fresh water in the double bottom tanks below. Fifty Pneumercator gages are connected to the tanks.

The deep tanks in No. 3 hold will be arranged as settling tanks. The fuel oil will be transferred from the double bottom tanks to the deep tanks for settling and thence to the service tanks at the sides of the boiler rooms. Arrangements are made for pumping oil from any deep tank to any service tank while transferring oil from any double bottom tank to a deep or settling tank.

Oil Transfer System

Duplicate service systems are provided in the three forward boiler rooms, with pumps (9 by 6 by 10 inch vertical duplex), heaters and strainers and the transfer systems (10 by 12 by 12 inch vertical duplex pumps) are also in duplicate. Boiler room 4 will have 2 duplicate sets of service pumps of smaller size (7½ by 4½ by 10 inch) as the boilers in this room will be used in port. The oil heaters are of the Griscom-Russell type.

An adequate system of oil heating coils is provided in each service and oil storage tanks capable of raising the temperature of the oil from 40 to at least 130 degrees F.

In boiler room 4 a new donkey boiler, supplied by the Consolidated Shipbuilding Corporation, Morris Heights, New York, is installed to supply steam direct to the service pumps in boiler room 4 and to the manifold controlling steam to the oil heating coils in the service tanks in this boiler room.

Overflow System

In every compartment used for storage of fuel oil an overflow system is provided so that the highest pressure in the tank cannot exceed that due to a head of oil up to the highest point of the overflow system. The system is divided into two main sections, one for the tanks forward of the boiler rooms and the other for the tanks in way of the boiler rooms. The overboard overflows of both systems are at the side of the vessel about 5 feet above *G* deck and are fitted with non-return valves to prevent shipping of seas in rough weather.

Fire Protection in the Boiler Rooms

With the conversion of the vessel from coal to oil burning it became necessary to provide the utmost protection against the fire hazard involved in the handling, storage and burning of fuel oil. For this purpose a very complete Firefoam fire extinguishing system is being installed by Charles Cory and Son, Inc., New York, designers and installation engineers of the system.

In general, the system comprises two solution tanks having a capacity of 3,500 gallons each, installed on *H* deck over boiler room No. 3, which are used to store the "A" and "B"

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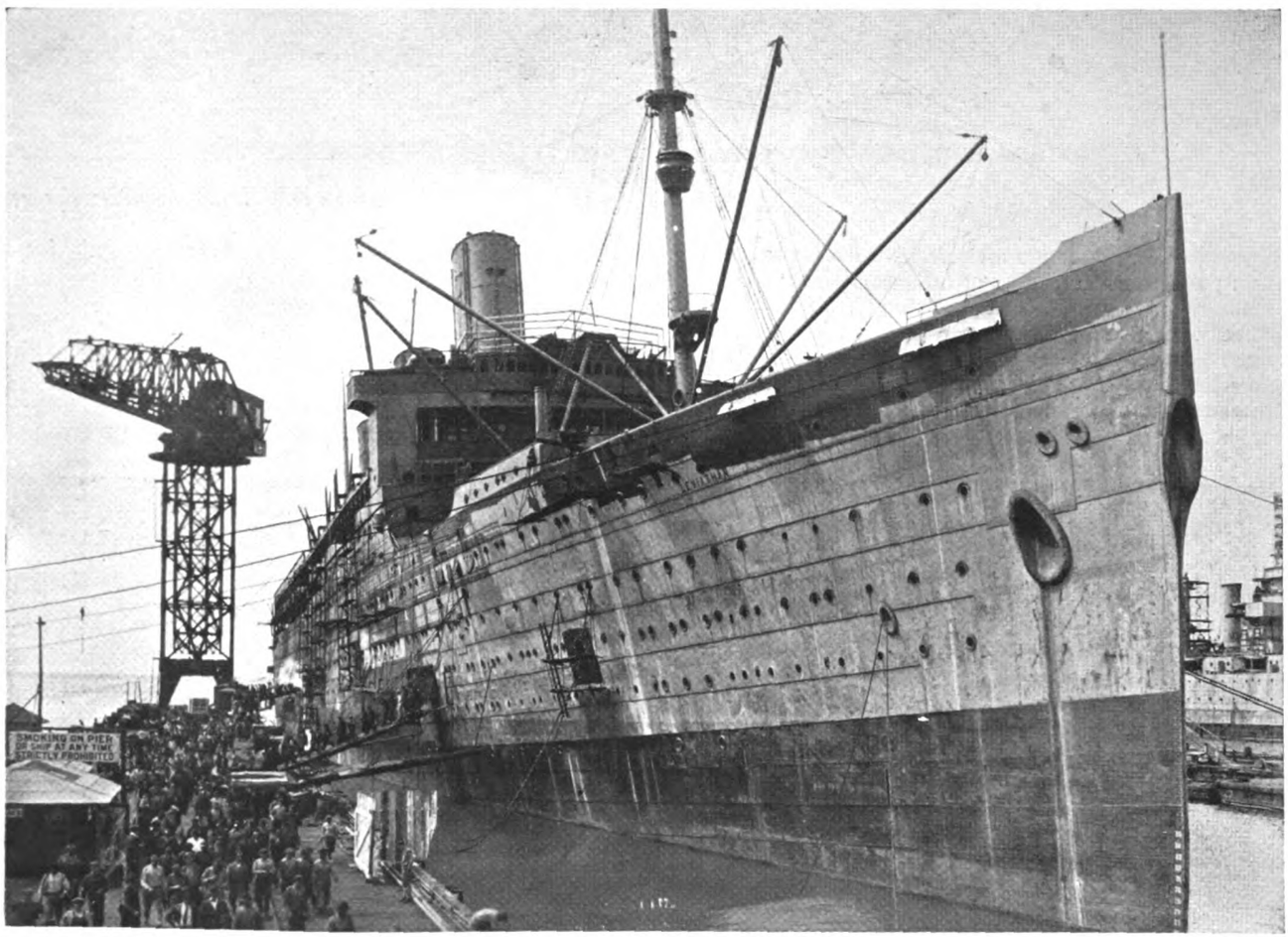
Firefoam solutions. Two independently driven pumping units, one electric and the other steam, are employed to pump the solutions to any one of the four firerooms, or to any filling station. The Northern Fire Apparatus Company's positive displacement rotary pumps syphon the solution from the tanks and discharge into the feed lines at a rate of 400 gallons of each solution per minute. One twin unit is driven in tandem by a 50 horsepower Albergen-Curtis steam turbine and a duplicate unit by a 50 horsepower Diehl Navy standard watertight motor.

The solutions are conveyed from the pumps to the various compartments and mixed in specially designed distributors, which are installed in such a manner over the tank tops and other places where oil can collect that the foam, formed by impinging the solutions in these distributors, will be completely spread over the surface of the fire. These distributors are also placed in all filling stations on *F* and *G* decks. In addition to the distributors, each boiler room is equipped with four Firefoam hose hydrants, with the exception of No. 1 boiler room, in which there are five. The hose is intended to be used to combat incipient fires above the floors and in pump rooms adjacent to the firerooms.

A rather unique method of controlling the various valves and pumping units has been devised. In each fireroom there are located special levers which control the valves supplying solutions to the distributors. Means are also provided in each adjacent fireroom so that, in case of fire, it will be possible to operate the system from an adjacent fireroom, or from the one affected. Separate controls are installed for all hose hydrants. A positive tripping mechanism is used on the control valves, which are operated in pairs on account of the two different liquids. When the tripping device is released, large coiled springs open the valves and eliminate undue strains on the control gear.

Simultaneously with the operation of any one of the controls, whether it is in one of the firerooms or filling stations, an electric contactor mounted on each pair of valves closes the circuit for the automatic magnetic lockout control panel and starts the electric motor driven pumping unit. The closing of this circuit also energizes the solenoid of a Cory electro-mechanical valve controlling the supply of steam to the turbine driven unit. Relief valves permit the solution to return to the respective tanks should the pressure build up above that for which the system has been designed. To provide against failure of the electric current aboard, the mechanical controls to all valves are so connected with the electro-mechanical steam valve that this valve is automatically opened and steam supplied to the turbine driven pumping unit whenever a control lever is operated.



Workmen Coming Off the Leviathan at the Noon Hour. Over 2,900 Men Are at Work on the Vessel Each Day

HEATING AND VENTILATION

An entirely new steam heating system has been installed throughout the ship, designed and tested to withstand the full boiler pressure of 248 pounds per square inch, although the usual pressure carried in the system will not be over 30 pounds per square inch. The radiators, which are installed in all the public rooms and staterooms, with the exception of the steerage and crew's quarters forward, where the air supplied to the rooms is heated by a thermotank system, consist of copper coils designed and built by the Newport News Shipbuilding and Dry Dock Company. By making the steam heating system capable of withstanding full boiler pressure

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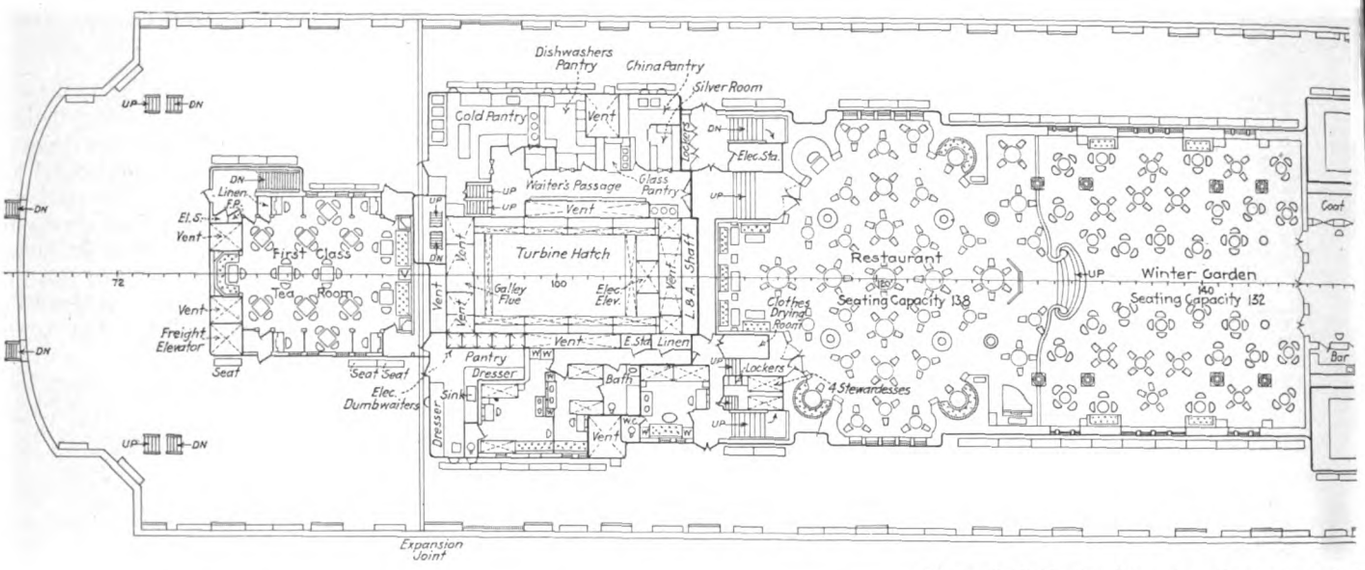
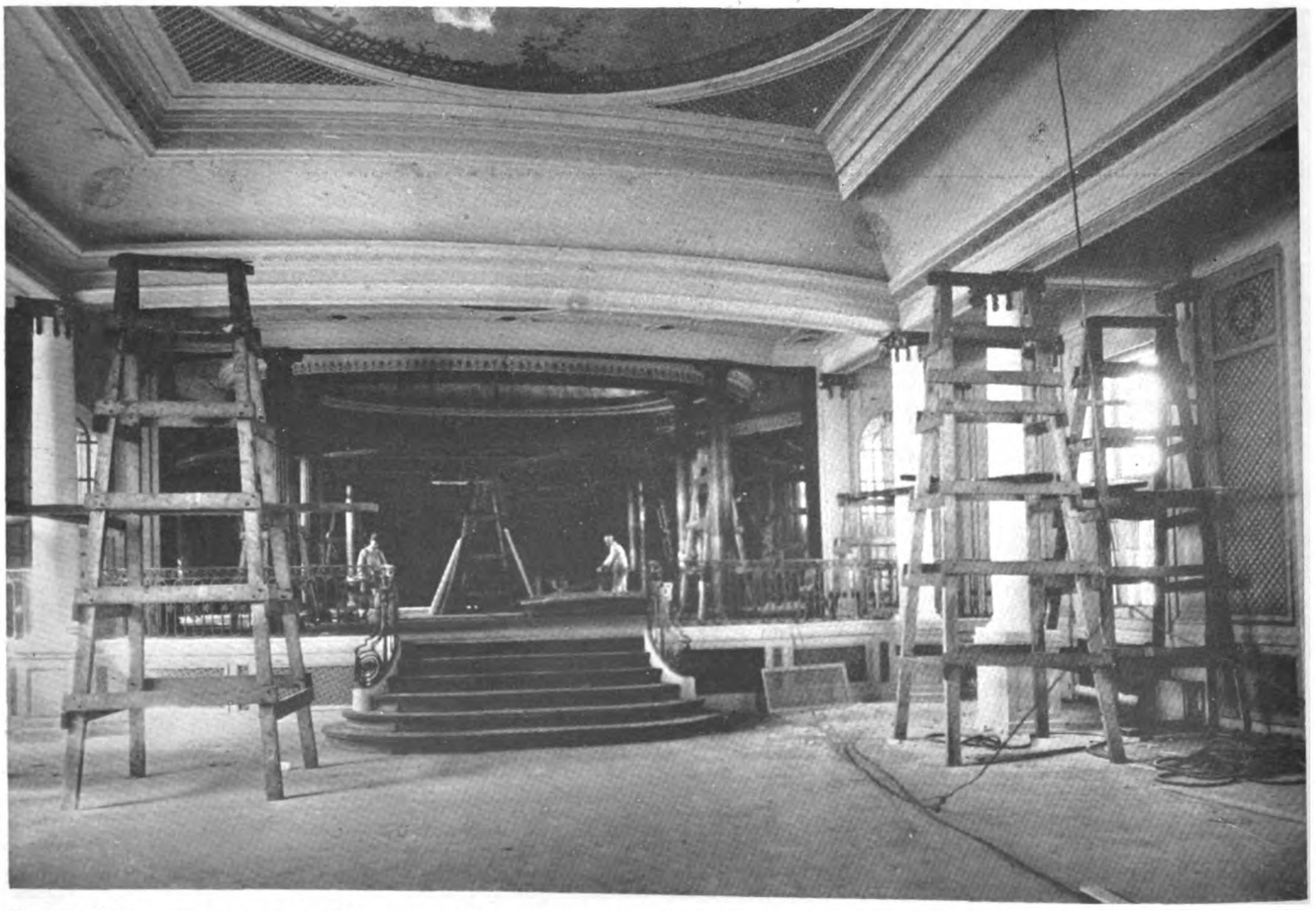


Plan of B Deck, Showing Arrangement of

the vessel and passengers are safeguarded against damage or injury due to the possibility of full steam pressure ever being inadvertently admitted to the system.

Ventilation of the ship is accomplished by means of 124 separate ventilating systems, including 58 supply systems, 58 exhaust systems, six circulating fans for the refrigerating rooms and two propeller fans for the battery charging room. With the exception of the two propeller fans and eight blowers of 5,000 cubic feet per minute capacity each for the former coal bunker spaces on *H* deck which will be used for emergency passenger quarters, the ventilating fans, numbering 114, will consist of the old equipment originally installed but overhauled and placed in first-class working condition. The new fans are of the Sturtevant type.

All passenger and crew's quarters are being ventilated mechanically. In the steerage and crew's quarters the air



In the Winter Garden and Restaurant on B Deck the New Electric Wiring Is Complete and the Work of Decoration Is Under Way. The Panel at the Right, Consisting of Green Trellis Work on a Gray Panel With Gold Trim, Shows the General Scheme of Decoration for the Winter Garden

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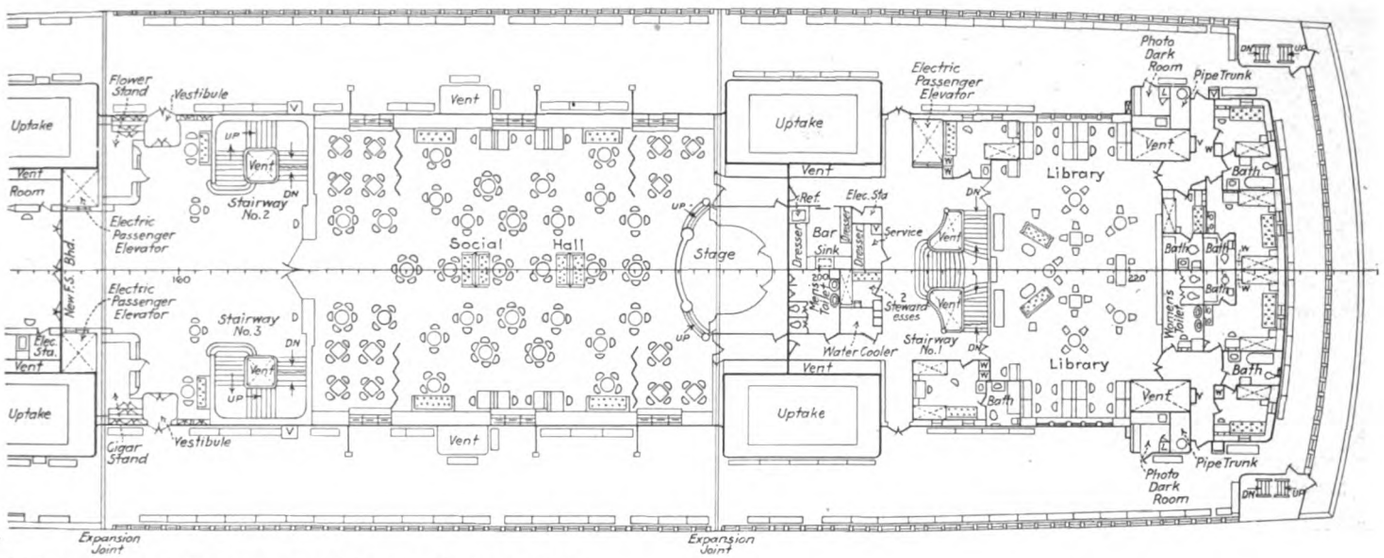
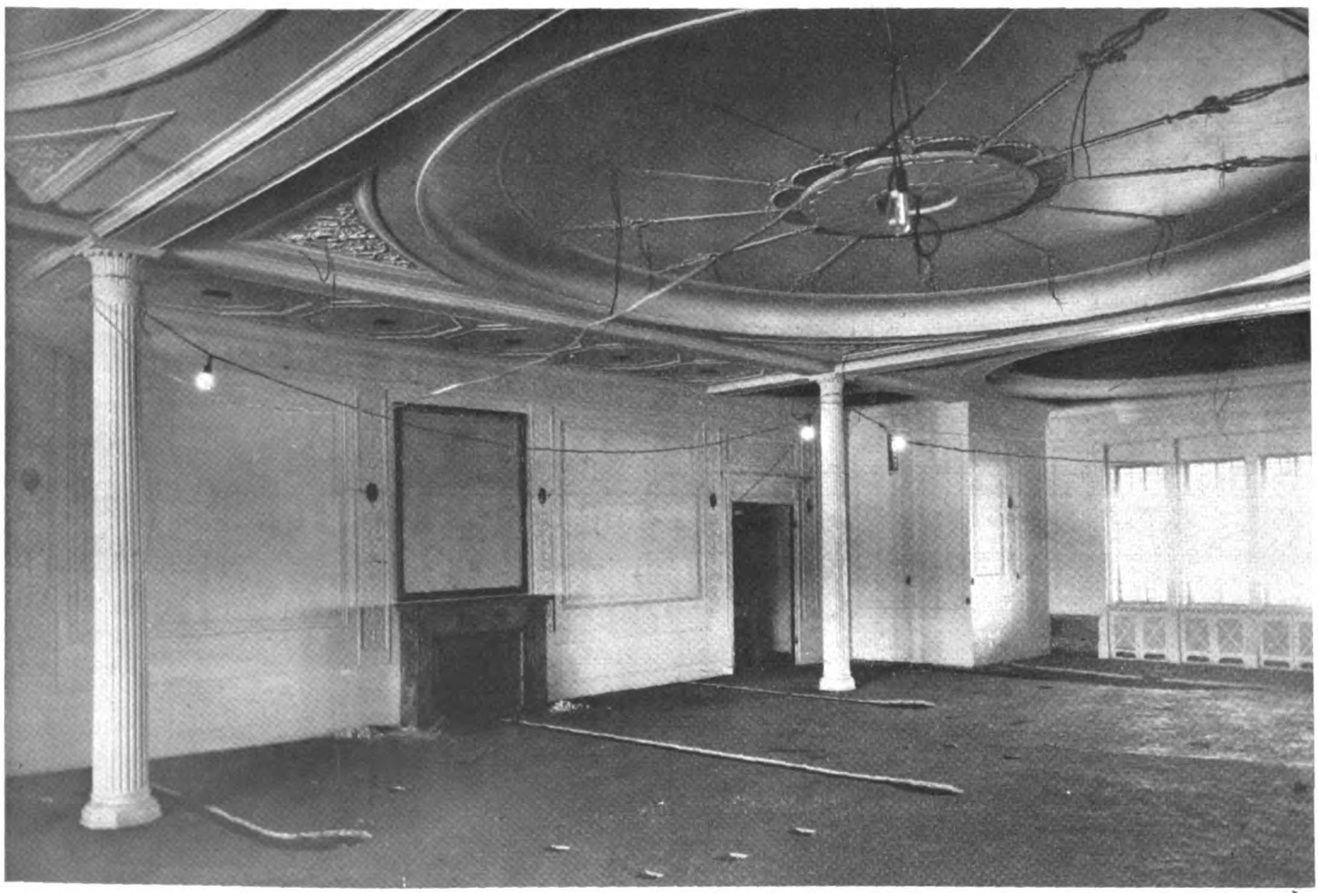


Principal First Class Public Rooms and Promenade

is heated by the thermotank system. Above *D* deck the ventilating ducts originally installed will in general be retained with slight changes. Below *D* deck, where the accommodations are being entirely rebuilt, the ventilating system is completely rearranged.

PLUMBING

All plumbing throughout the vessel has been removed and new plumbing of improved design installed. In all, about 55,000 feet of cold and hot fresh and salt water piping have been installed in the ship. For supplying the sanitary system six sanitary pumps are installed, three on each side of the ship in the engine room. The salt water supply is pumped through a 10-inch pipe to a 5-ton gravity tank located about 35 feet above the bridge deck in the after stack, which is a dummy located directly above the engine room hatch. In this



The Main Library on B Deck Is One of the Few Rooms on the Ship Comparatively Free from Scaffolding and Other Signs of the Activities of the Workmen. Here the Wiring and Ventilating Ducts Are Complete But the Floor, Ceiling and Walls Await the Finishing Touches

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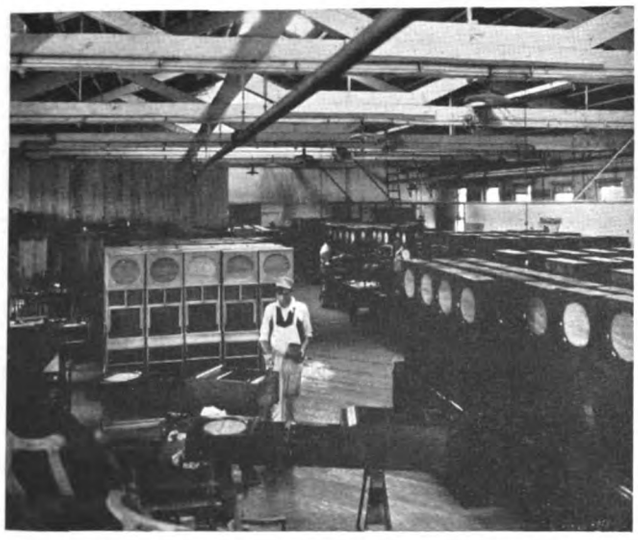


Section of the Joiner Shop in the Newport News Yard Where Much of the Furniture for the Leviathan Is Being Manufactured

position the tank gives ample gravity pressure all over the ship.

From this gravity tank a 12-inch supply pipe leads down to a point below *H* deck whence it runs fore and aft the full length of the engine and boiler rooms, supplying water to risers in three trunks.

The main feature of the sanitary system is the arrangement of the gravity tank, which is fitted with a slide valve operated by a float at the top of the supply pipe to the tank. This is so arranged that when water is drawn from the tank the float drops, opens the slide valve and admits water to the tank. When the valve opens the sanitary pump starts and keeps pumping water into the tank until the valve is closed by the lift of the float.

The pressure in the supply pipe from the pump to the tank is always kept at 150 pounds per square inch and is regulated by a governor valve fitted on the steam line to the pump. A diaphragm in the governor valve is connected to the supply line to the gravity tank so that, when the slide valve in the gravity tank opens and the pressure in the pipe falls slightly, steam is admitted to the pump and the pump starts, maintaining the pressure in the line close to 150 pounds per square inch. When the gravity tank is full and the slide valve closes, the pressure in the pipe rises slightly and shuts off steam to the pump.

The object of the slide valve and float in the gravity tank is to make it possible to keep a pressure of 150 pounds per square inch in the supply line so that the fire line can be taken from the same manifold and always have adequate pressure in the fire line system and at the same time have the sanitary supply from the gravity tank to the cold and hot water systems supplied by gravity without interruption.

Fresh water is distributed throughout the ship in a manner similar to that used for the salt water supply described above, except that the pressure in the supply pipe for the fresh water system is lower than that in the salt water supply pipe. In this case the gravity tank is also located in the dummy stack over the engine room hatch. The main supply pipes of the system run fore and aft below *H* deck the full length of the engine and boiler rooms. On *H* deck are located three salt water and three fresh water heaters, each with a capacity of about 20 tons per hour capable of heating the water from 40 to 140 degrees F. The heaters are especially designed so they can be taken apart and each part carried through the door of the compartment where they are installed.

Each section of the hot water system throughout the ship is fitted with a return pipe and a circulating pump located near the heater for the section on *H* deck. With this arrangement hot water is continuously circulating through the system, assuring a supply of hot water at all outlets at the instant a faucet is opened. "Sands" plumbing fixtures are used throughout the ship.

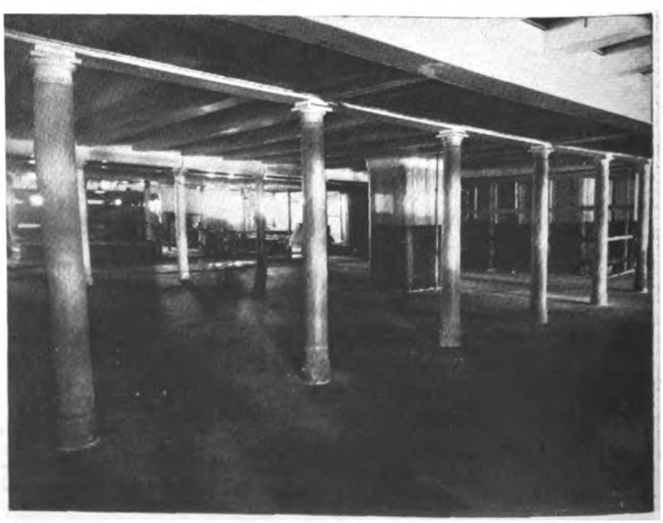
All of the heaters are interchangeable so that if for any reason one is out of commission the supply of hot water is not interrupted.

Piping for the hot and cold fresh water and cold salt water systems is of wrought iron while for the hot salt water system it is of copper. Iron pipes 1¼ inches and above are expanded into the flanges. In the copper piping the flanges are brazed on. All flanges up to 3 inches are of the hydraulic two-bolt type; above 3 inches the flanges are of the hydraulic type, round with four or more bolts.

Drainage System

All soil pipes, waste pipes from lavatories, floor drains, etc., leading from *G* deck overboard are fitted with a hydraulically operated emergency shut-off valve so that, if, from collision or other cause, one or more watertight compartments are flooded and the vessel sinks below *G* deck, all the valves can be instantly closed by turning a single handle in the engine

Restaurant Galley on A Deck. The New Ranges and Equipment Are Just Being Installed



View in Second Class Dining Room, Where Lit-O-Sil-O Flooring Has Just Been Laid

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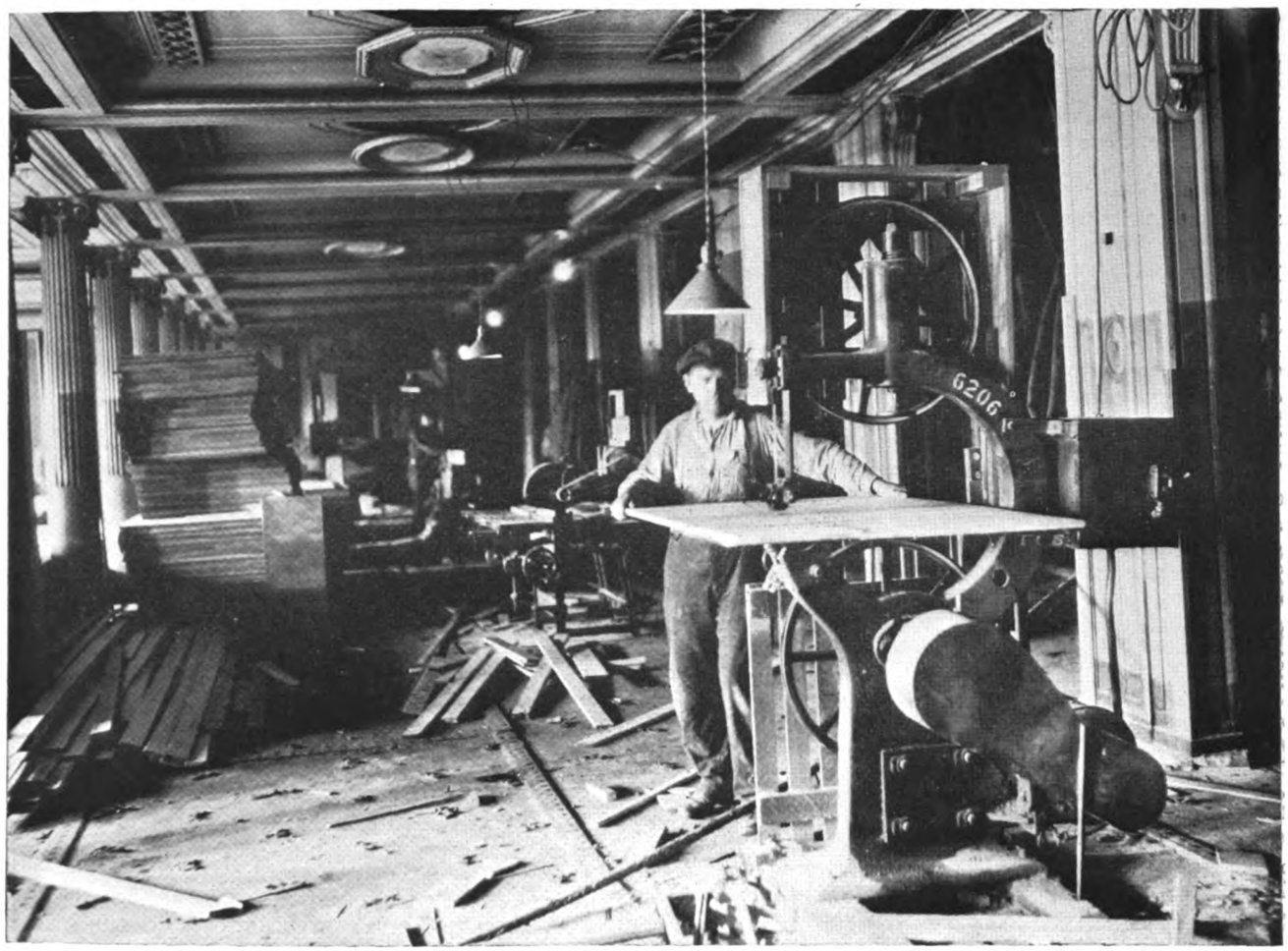

In the First Class Dining Room on F Deck Wood Working and Other Electrically Driven Machinery Has Been Temporarily Installed and the Room Has Become a Busy Workshop for the Finishing of Panels and Other Wood Work

room, thus preventing water from backing up through the plumbing fixtures and deck drains.

In general the drainage piping is the same as originally fitted in the vessel, except that slight rearrangements have been made to suit new arrangements of fixtures.

ELECTRICAL PLANT

Electric current on the *Leviathan* is required for lighting over 15,000 electric lamps and for operating approximately 312 motors, ranging in size from 1/6 to 50 horsepower each and totaling 2,150 horsepower. The current is supplied by four 288-kilowatt turbo generating sets originally installed in the vessel and a new 500-kilowatt set supplied by the General Electric Company, Schenectady, N. Y. The new set is of the type which has proved so satisfactory in United States naval vessels and is guaranteed to operate in parallel with any or all of the retained German generating sets.

The generators supply direct current at 115 volts. The turbines of the retained sets are of the Parsons type made by Brown, Boveri & Cie. and are rated at 445 horsepower at 2,000 revolutions per minute. The generators are compound wound with 6 poles, were constructed by the Siemens, Schuckert Company, of Berlin, Germany, and are direct connected to the turbines.

DISTRIBUTION

The dynamo room in which the current is generated is located in the hold between the propeller shafts, abaft the engine rooms. From the dynamo room the current is conducted to a main primary station on *G* deck, nearly overhead, and from there is distributed about the ship through numerous sub-stations.

When the *Leviathan* was built all of the electrical wiring was installed on the one wire system. In reconditioning the vessel the old wiring from sub-stations to outlets was entirely removed and complete new wiring of the latest navy type was fitted throughout the vessel. Up to the substations the one wire system is used but from the sub-stations to the outlets the two wire system is installed, except in a few cases where leads to some of the motors which were overhauled from the old equipment were retained. Both the wiring and fittings and all electrical equipment installed are designed to meet the most rigid underwriters' tests and inspections.

Special precautions have been taken to lessen fire risks and, as usual in reconstruction work, many interesting engineering problems have been encountered.

SWITCHBOARD

The original switchboard on the *Leviathan* was fitted with selective switches so arranged that the generators could not operate in parallel, *i.e.*, each set was assigned to some division of the load. This has been replaced by a new switchboard of the latest type so arranged that the generators run in parallel and pool their loads, which are distributed as required to the various systems. By this arrangement the plant can be operated more economically.

In the main primary station on *G* deck the subdivisions of load are made by grouping circuits at the panels. For lighting they are divided into groups such as general, police gangway, police cabin, etc., and also for festoon and prome-

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nade circuits. For power they are divided into groups such as ventilating sets, boat motors, elevators, etc.

LIGHTING

From the main primary station on *G* deck the circuits are carried to sub-stations where enclosed, dead front panels are installed, fitted with double pole switches, and equipped with N. E. C. fuses. From this point to the lights the circuits are installed on the two wire system.

The fixtures in the public rooms and passenger quarters, supplied by the Sterling Bronze Company, are very elaborate and are especially designed for the locations. In the working part of the ship watertight fixtures are used throughout. Approximately 15,000 electric lamps will be installed, exclusive of festoon lamps and the like which will be provided for decorating the vessel on special occasions.

WIRING

Leaded and armored conductors are used in all places subject to dampness and in all working parts of the ship. In the passenger accommodations armored conductors are used and every precaution is taken in their installation to lessen fire risk, such as the provision of special outlet boxes at fixtures, kick pipes at the decks, guards to prevent injury of conductors and the like.

ELECTRICAL POWER SYSTEM

The electric power system comprises ventilating sets for the supply of forced ventilation to all parts of the vessel, electric ranges, elevators, an elaborate system of winches for handling lifeboats and the like, moving picture equipment, etc.

EMERGENCY LIGHTING

In addition to the above, and wholly separate from it, is an emergency lighting and power system supplied by two 60 kilowatt General Electric generators driven by direct connected Worthington Diesel engines. The emergency sets are located well aft to avoid noise in the staterooms and on *E* deck well above the waterline.

In connection with the emergency system an automatic switching arrangement is provided so that, if the current supply should fail, due to the main generators becoming inoperative for any reason, the emergency circuits would automatically be shifted to current supply, first from an emergency storage battery and then to current from one or both of the emergency generators. The capacity of the emergency generators is sufficient to light all parts of the ship essential for operation, the exit of passengers to lifeboats, the lowering of the boats and the operation of the wireless and other signalling systems.

As a further precaution the switching system is divided to automatically provide separate emergency service for the machinery spaces and other working parts of the ship. All lifeboat lighting is controlled by one switch from the bridge and special features are included such as twelve 500 watt lights for illumination oversides when launching lifeboats.

INTERIOR COMMUNICATION

All the latest devices for interior communication, signaling, recording, etc., are provided. These systems are controlled from a room on *E* deck well above the waterline. Current is supplied from two motor generators, each with a 17 horsepower 110 volt direct current motor, a 3.75 K. V. A., 112 volt, 50 cycle, single phase alternating current generator and a 7.6 kilowatt 26 volt direct current generator. For emergency use there is a 26 volt storage battery which may be connected to the desired circuits upon failure of the motor generators.

The emergency storage batteries are liberal in capacity and are in duplicate. They are so arranged that one battery must always be connected for operation and only then is the other available for charging, so that after it is charged it can be thrown in prior to the exhaustion of the other battery.

The various interior communication and signalling systems will be briefly referred to under their respective names, in the following:

Searchlights.—One 36-inch high power searchlight, supplied by the Sperry Gyroscope Company, Brooklyn, N. Y., and embodying all the latest developments will be installed and there will be two portable 12-inch incandescent searchlights for use in docking the vessel, picking up buoys, and similar operations.

Telephones.—The ship's service telephone system extends to all parts of the vessel, including each first class stateroom. In all, over 600 telephones are connected to the central station, which consists of a two position lamp type Western Electric Company switchboard. In addition there are the usual telephone systems for the operation of the ship, including the following: Fire and engine room loud speaking system; loud speaking maneuvering circuit, between 14 operating stations; local circuit between ship's officers' quarters.

Fire Alarms.—For protection against fire two systems are employed, one pneumatic and the other manual; both of which are new.

The pneumatic system (Aero fire alarm) functions on the principle of a rising temperature in the compartment or stateroom covered causing an increase of pressure of the air in a small copper tubing which is run through the staterooms and compartments. There are approximately 300 circuits of this tubing, terminating at 26 section panels.

The vessel is divided into twelve sections, panels being located at approximately the center of each section where possible. By means of an annunciator drop these panels indicate which circuit in that section has operated and also transmit the panel section and deck location to the fire watchman's station.

The manual fire alarm system consists of 45 alarm boxes from which an alarm can be sent in to the watchman's station. Electrical supervision is constantly maintained over both systems which announces the instant a circuit is broken or other trouble develops.

Watertight Door Alarm.—The watertight doors operated from the bridge, of which there are about 60, are equipped with contact makers which indicate on a diagram board on the bridge the position of each door. Alarm bells are located near each door, which are rung prior to the movement of the door. This alarm system forms a part of the hydraulic door control apparatus and prevents doors being operated without warning.

Clocks.—Electric clocks located in various public rooms and in many of the first class staterooms and suites are operated and controlled from the bridge. They can be simultaneously reset in either direction from the bridge as time changes occur during the trip. The control of the clocks is arranged on four circuits, there being an average of 35 clocks on each circuit.

Annunciator System.—An elaborate annunciator system covers the first and second class sections of the ship. Steward and stewardess buttons when operated in the various staterooms cause a lamp signal to operate at the nearest service station, giving the room number and class of service desired. This signal remains set until answered at the door of the stateroom from which the call was sent. At this point a reset button, operated by the steward or stewardess answering the call, releases the signal and restores the system to a condition ready for future calls.

About 80 of these section annunciators are installed, each covering ten rooms and being located centrally in the sections which they serve. The cases of the annunciators are of ornamental brass in a design which harmonizes with the surrounding joiner work. Additional annunciator systems are

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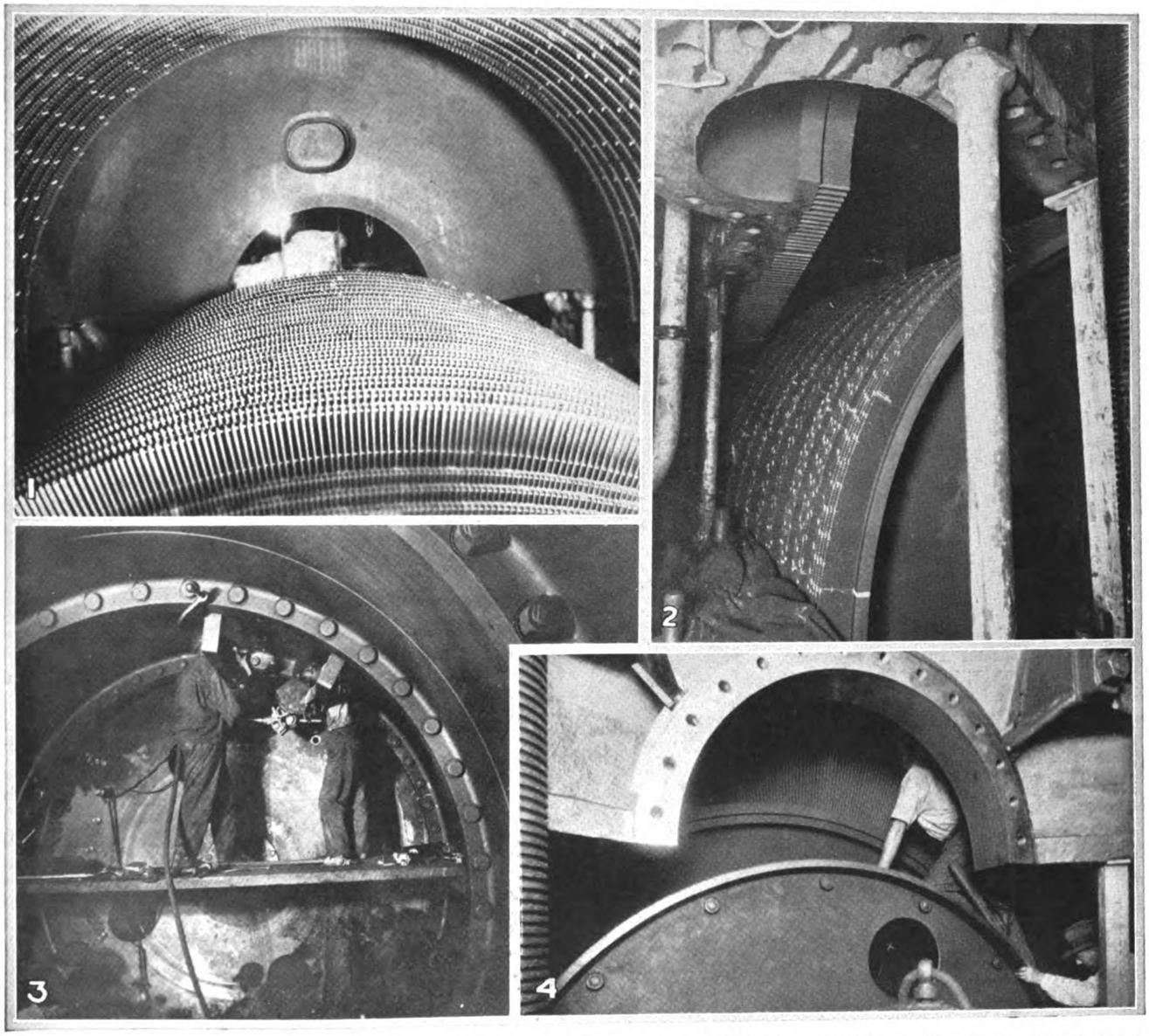

Overhauling Main Turbines of the Leviathan: (1) Blading of Low Pressure Turbine; (2) Upper Casing of Low Pressure Turbine Raised, Showing Rotor; (3) Interior of Low Pressure Rotor; (4) Inspecting One of the Turbines

installed for the smoking rooms, swimming pool and bridge deck officers' quarters.

Bridge Equipment.—The apparatus on the bridge for the navigation and operation of the ship is as complete and modern as the science of shipbuilding can make it and covers engine telegraphs, installed in duplicate, revolution indicators, docking and anchor telegraphs, steering and rudder telegraph systems, whistle systems, iceberg danger signal system, submarine signal system and a life buoy system.

Sperry gyro compasses are installed in duplicate, with repeaters located at steering stations. A recorder is also installed for making a permanent record of all courses taken while under way.

Engine Room Equipment.—In the engine room are a number of special electrical signaling and recording systems all indicating at one central point. In this way the salinity of the feed water and the temperature of the fuel oil are indicated. A tableau board indicating the position of the various valves used to control the turbines is also installed and means are provided for transmitting the shaft speed from each of the four turbines to the boiler rooms, the engineers' log room and to the bridge.

CHANGES TO FORCED DRAFT SYSTEM

The air supply to the after engine room is being doubled, with changes in the ventilating machinery and ducts. The duct to the forward engine room is divided, being made watertight to *F* deck and of light construction to the bridge deck, where two electrically driven multivane fans of 60,000 cubic feet of free air per minute are installed. The ventilation of the main galley is also being rearranged.

STEWARD'S DEPARTMENT

With a full complement of passengers and crew the *Leviathan* will carry a total of 4,499 persons on her regular voyages.

To prepare the food for the restaurant, first class dining room, second and third class passengers, steerage, officers and crew there are seven complete galleys and four bakeries and the service of each is taken care of in a separate pantry. Each galley has its own storerooms, butcher shop and other facilities.

GALLEYS AND PANTRIES

In design, arrangement and equipment the galleys and pantries will enable the operators of the vessel to offer to

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ocean travelers a service superior to anything hitherto attempted afloat and unrivaled in any of the finest hotels ashore. Waste and labor will be cut down by the general adoption of electrically driven machinery in all the galleys and pantries and modern methods of administration will insure economical and efficient service in hot or cold climates.

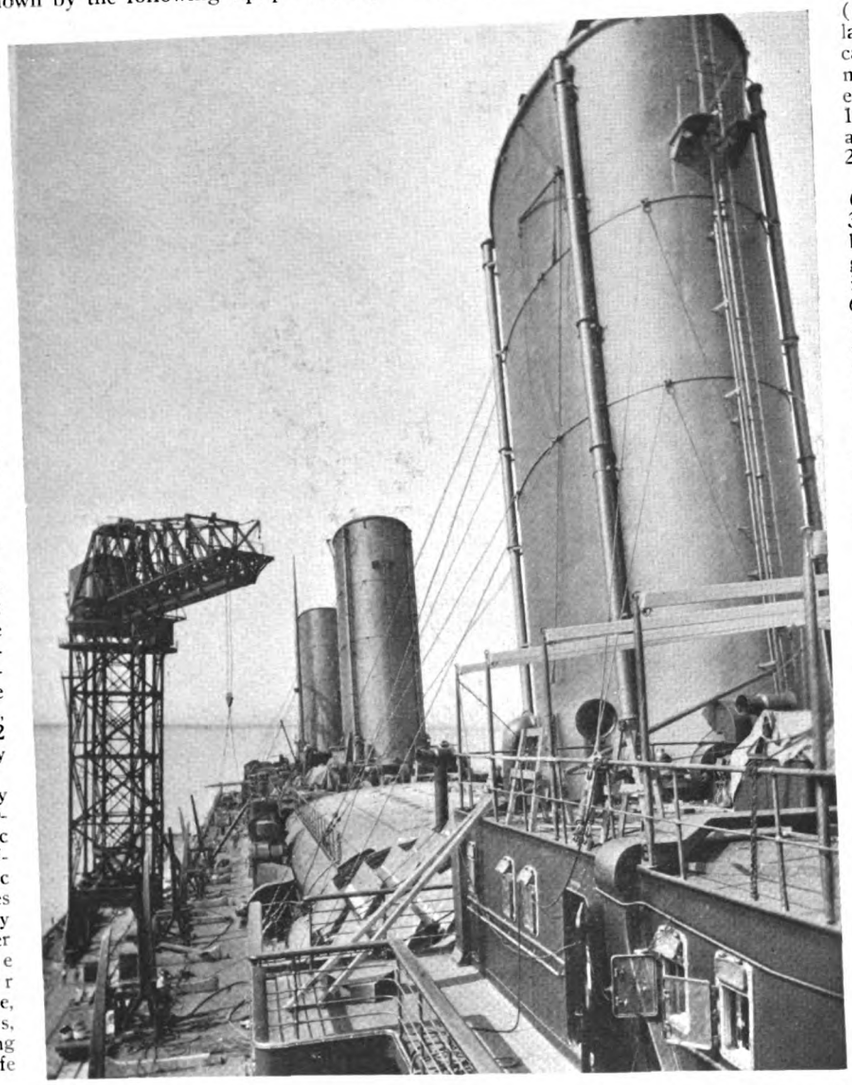
Some idea of the extent to which modern electrically driven machinery is supplanting manual labor in these modern galleys and pantries is shown by the following equipment, supplied by the S. B. Sexton Company, Baltimore, Md., which is to be installed:

Restaurant Galley (on *A* deck, serving restaurant, winter garden, tea room and officers' dining room).—Six ranges, 1 bake oven, 2 grills, 1 ice cream maker, 1 meat and vegetable chopper, 1 bacon slicer, 1 potato peeler, 1 griddle, 1 waffle iron, 1 bread slicer, 1 coffee mill, 1 pastry mixer, 1 dishwashing machine (capacity 3,000 dishes per hour), 1 automatic toaster, all electrically operated.

First Class Galley (on *F* deck).—Two 8-fire island ranges, one 2-fire single range, 2 meat and vegetable choppers, 1 high powered mixer and whisking machine, 2 large capacity potato peelers, 4 60-gallon kettles, 12 2-section heavy duty vegetable steamers.

First Class Pantry (on *F* deck).—Six 20-gallon urns, 4 electric toasters, 1 electric coffee grinder, 2 electric dishwashing machines (each with a capacity of 15,000 dishes per hour), 1 double combination silver burnishing machine, electric bread slicers, griddles, ice cutting machine and knife cleaning machine.

In the first class dining saloon there are 48 electric plate warmers and in the restaurant 18 plate warmers.



Looking Aft from the Leviathan's Bridge, Starboard Side, Showing Material Being Placed on the Boat Deck by the 120-Ton Hammer Head Crane on the Fitting Out Pier Alongside

First Class Bread Making and Baking Rooms (2 on *F* deck).—Two heavy duty electric dough mixers (each of 2 barrels capacity), 2 electric ovens (each with a capacity of 180 one-pound loaves), roll dividing machine capable of producing 36 rolls at one operation, each roll of identical weight to the fraction of an ounce.

Pastry Room (on *F* deck).—One electric ice cream maker, 1 electric pastry mixer and whisking machine, 1 electric pie crust roller (capacity 25 crusts per minute), 1 electric griddle, 1 waffle iron (capacity 36 at one operation), 1 electric oven (capacity 60 one-pound loaves per hour).

Butcher Shop (on *F* deck).—Latest type, heavy duty electric meat chopper; electric bacon slicer and ice shaver.

Second Class Galley (on *F* deck).—One 6-fire range, four 50-gallon steam kettles, two 2-section vegetable steamers, 58-foot steam press and bainmarie.

Second Class Pantry (on *F* deck).—Three 20-gallon urns, electric toaster, griddle, coffee grinder, knife cleaning machine and dishwashing machine (capacity 15,000 dishes per hour).

Third Class Galley (on *E* deck).—One 4-fire island range, three 50-gallon kettles, one 800-pound capacity vegetable steamer, 1 heavy duty electric potato peeler, 1 electric vegetable and meat chopper.

Third Class Pantry (on *E* deck).—One electric dishwashing machine (capacity 6,000 dishes per hour), bread slicer, coffee grinder, knife cleaner, six 20-gallon coffee urns, 33-foot hot press and bainmarie.

Steerage Galley (on *D* deck).—One 3-fire, single front, coke-burning range, three 50-gallon kettles, one 800-pound capacity vegetable table steamer, electric heavy duty potato peeler.

Steerage Bakery (on *D* deck).—One latest type, 2-barrel capacity electric dough mixer, 1 heavy duty electric oven (capacity 180 one-pound loaves at one baking), two 20-gallon kettles.

Steerage Pantry (on *F* deck).—Three 30-gallon urns, electric bread slicer, coffee grinder and dishwashing machine (capacity 6,000 dishes per hour). An electric elevator connects the pantry with the galley three decks above.

Petty Officers' Galley (on *D* deck).—Special range, vegetable steamer, coffee boilers, electric coffee grinder.

Refrigerators

In addition to the main storage refrigerators on *J* deck for the preservation of perishable stores there are 20 service refrigerators distributed throughout the ship for the economical preservation of the proper foods at the required temperatures for the various classes of passengers. Twelve large refrigerators are for the first, second and third class passengers, while there are six others for restaurant supplies. To localize food for the crew and steerage passengers, four service refrigerators are installed forward on *D* deck and one on *E* deck. An ice-making plant, with a capacity of 6,720 pounds per 24 hours, is located on *H* deck. For easy handling the ice is made in 24-pound blocks and is sent from *H* to *F* decks by a special elevator. All new refrigerating apparatus is supplied by the Brunswick-Kroeschell Company, New Brunswick, N. J.

In order to facilitate serving passengers in the public rooms pantries have been constructed and fitted with all equipment necessary adjacent to the main social hall, winter garden, smoking room and tea room. For the convenience of passengers 43 ice water fountains supplied from brine cooled scuttle butts are distributed throughout the ship.

All pantries, service rooms, galleys and storerooms

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throughout the ship are connected to the chief steward's office by telephones.

STEWARD'S SUPPLIES AND EQUIPMENT

Supplies and equipment for the steward's department costing about $600,000 are being furnished by Gimbel Brothers, New York, in accordance with a contract awarded to this firm by the Shipping Board through its agents, Gibbs Brothers, Inc., New York. In all cases the equipment is the finest that can be procured and some idea of its quantity can be gained from the following items:

The linen for the first class dining saloon and restaurant and the sheets and pillow cases for the first class quarters is manufactured by McCrum, Watson and Mercer, Ltd., Milford, Ireland, and H. Matier and Company, Ltd., Belfast, Ireland, comprising about one-half of the linen required for the ship.

The linen for the second and third class passengers is manufactured by Hay and Robertson, Ltd., Dunfermline, Scotland, and H. Matier and Company, Ltd., Belfast, Ireland.

The silverware, supplied by the R. Wallace and Sons Manufacturing Company, Wallingford, Conn., totals more than 71,798 pieces of flat and hollow ware.

The china for the various dining rooms, manufactured by the Onondaga Pottery Company, Syracuse, N. Y., totals 102,000 separate pieces. The tea service sets for the restaurant and first class dining room are manufactured by Lenox, Inc., Trenton, N. J., making a grand total of 119,278 pieces of china.

The glassware, manufactured by the United States Glass Company, Pittsburgh, Pa., totals 48,084 pieces.

The equipment for the galleys and pantries, supplied by the Bramhall, Deane Company, New York, totals 23,000 pieces.

Other equipment, such as cotton sheets and pillow cases, steamer rugs, towels, etc., is being supplied in corresponding quantities by various manufacturers to the order of Gimbel Brothers.

FRESH WATER TANKS

The fresh water is carried in the double bottom tanks and the former fresh water tanks aft of frame 150, including the two sections of the aft peak tank. In addition, two new fresh water deep tanks have been built aft. The boiler feed tanks have a total capacity of about 1,078 tons and the washing water tanks a capacity of about 1,667 tons. Two new vertical duplex pumps, 5¼ by 5 by 5 inches, have been installed for the drinking water system.

BALLAST SYSTEM

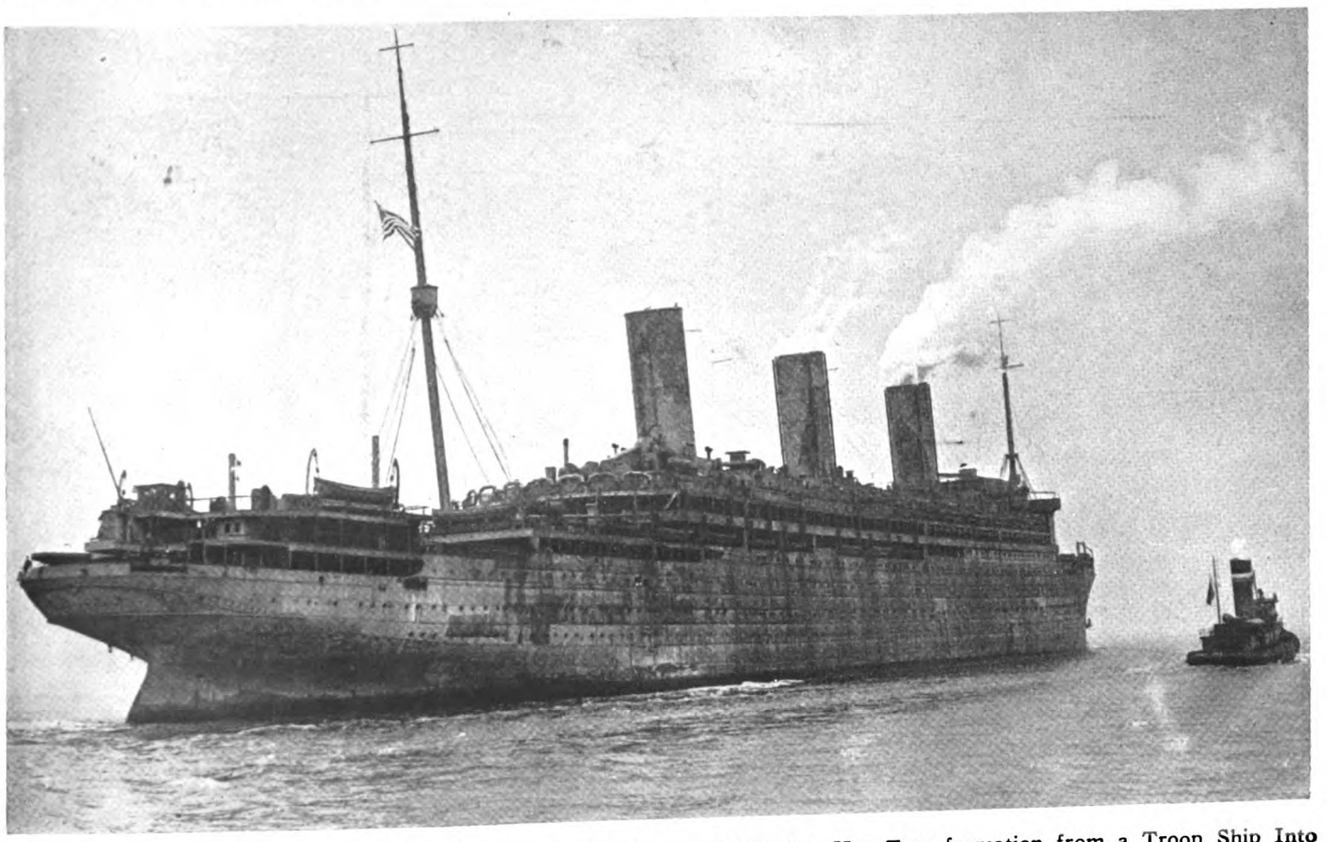
The former ballast system is being changed to provide a system for pumping ballast from all compartments used for the storage of oil fuel forward of frame 152 entirely independent of the oil handling, bilge or fresh water systems. The former ballast pumps are retained and one of the former ash ejector pumps has been connected to the ballast system.

LIFEBOATS

The lifeboat equipment of the *Leviathan* will have a capacity for 4,750 persons. In all 76 lifeboats will be carried of which 40 with a total capacity for 2,466 persons will be reconditioned from the former equipment of the vessel.

Of the new lifeboat equipment, which is supplied by the American Balsa Company, Inc., Long Island City, N. Y., 22 are 30-foot metallic lifeboats, each with a capacity for 76 persons; 2 are 26-foot metallic lifeboats, each with a capacity for 50 persons; 3 are 30-foot metallic pontoons, each with a capacity for 66 to 70 persons, and 5 are 28-foot metallic pontoons, each with a capacity for 58 persons. In addition there are two 30-foot wooden motor lifeboats, built by the Newport News Shipbuilding and Dry Dock Company from plans supplied by the American Balsa Company, Inc., and equipped with engines by the Standard Motor Construction Company, Jersey City, N. J., and two 22-foot work boats. The motor lifeboats will be fitted with powerful wireless equipment and will be used for towing or conveying the other lifeboats.

The lifeboats will be handled by Welin quadrant davits of improved design with Welin electric lifeboat winches, and will be fitted with Mills releasing gear and Welin non-toppling blocks.



As the Leviathan Looked When She Left New York for Newport News for Her Transformation from a Troop Ship Into the Finest Passenger Liner Afloat

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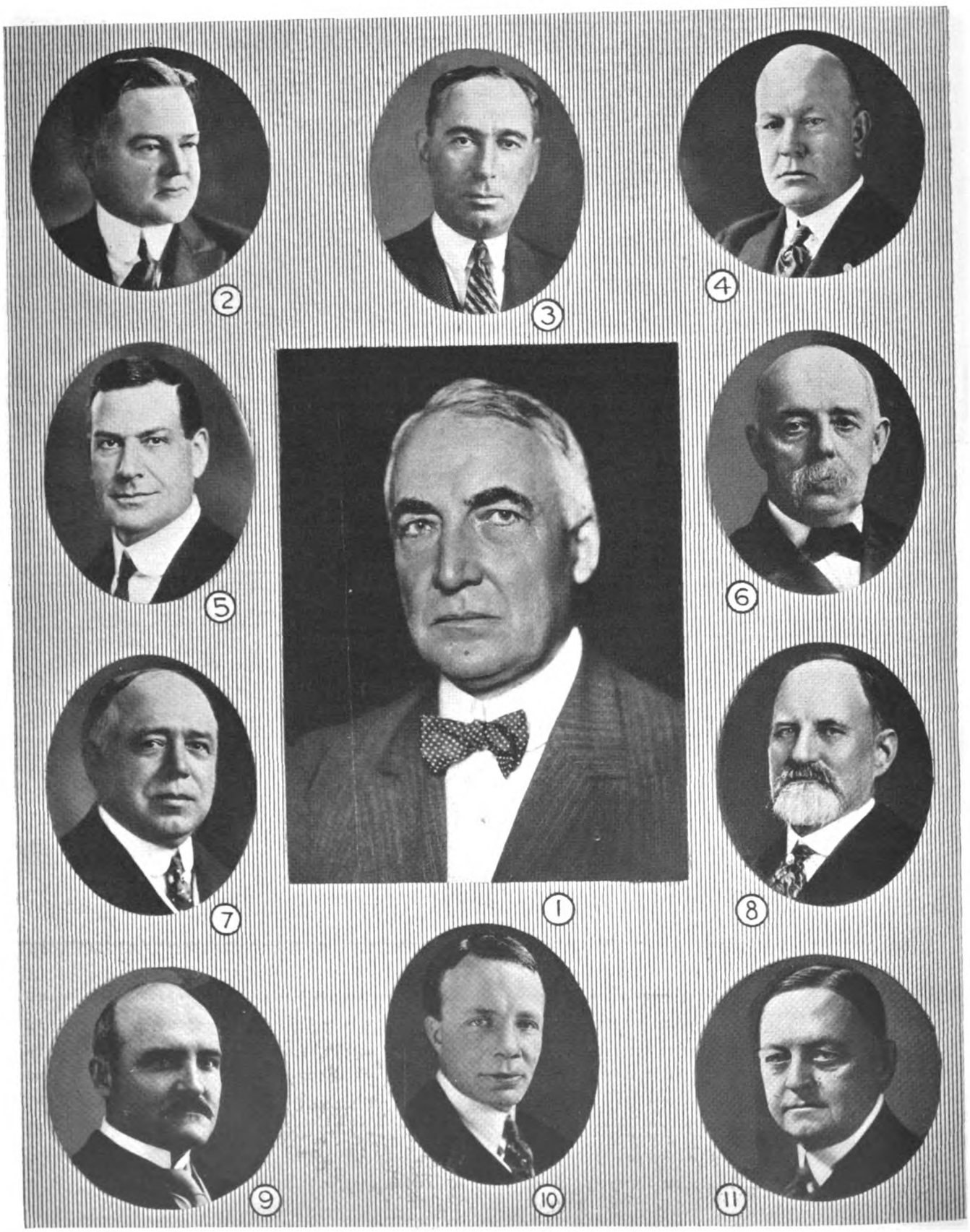

President, Statesmen of Both Parties, and Government Officials Who Are Leading Advocates for an American Merchant Marine

(1) Warren G. Harding, President of the United States; (2) Herbert Hoover, Secretary of Commerce; (3) Albert D. Lasker, Chairman of the Shipping Board; (4) Edwin Denby, Secretary of the Navy; (5) Senator Wesley L. Jones, Chairman of Committee on Commerce; (6) Congressman William S. Greene, Chairman of Committee on Merchant Marine and Fisheries; (7) Congressman George W. Edmonds, Vice-Chairman of Committee on Merchant Marine and Fisheries; (8) Senator Joseph E. Ransdell, President of National Merchant Marine Association; (9) Senator William M. Calder, Member of Committee on Commerce; (10) Colonel Theodore Roosevelt, Assistant Secretary of the Navy; (11) Senator Oscar W. Underwood, Democratic Leader of the Senate.

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Officers of the American Marine Association

(1) Colonel E. A. Simmons, *Marine Engineering and Shipping Age,* president; (2) W. M. Wampler, The Ellcon Company and Coen Company, Inc., vice-president; (3) Robert B. Lea, Sperry Gyroscope Company, secretary; (4) H. C. Davis, Row and Davis, Engineers, Inc., treasurer.

Big Program Prepared for American Marine Week

Marine Exposition at Grand Central Palace Larger Than Ever— Naval Architects and Marine Engineers Convene November 8-9

THE second American Marine Week with its Marine Exposition, the thirtieth annual convention of the Society of Naval Architects and Marine Engineers and the meeting and participation of eighteen maritime organizations will be held at the Grand Central Palace, Lexington avenue and 46th street, New York City, during the week of November 4-11. This will be the greatest co-operative maritime event that has ever been staged in this country and it is bound to attract the attention of the entire nation to the necessity for an American merchant marine.

President Warren G. Harding will send a message which will be delivered in person by Honorable Edwin Denby, Secretary of the Navy, at the annual banquet of the Society of Naval Architects and Marine Engineers, which will take place at the Waldorf-Astoria on the evening of November 9. The President, as is well known, is heart and soul in favor of a strong American merchant marine, adequate in size to carry the greater portion of our commerce and to serve as a naval auxiliary in time of war or in a national emergency.

A fair idea of the quantity and quality of the exhibits at the Marine Exposition may be obtained by a perusal of the Directory of Exhibits which is published on pages 691 to 695 of this issue. The United States Coast Guard turbo-electric drive cutter *Modoc* will be open for inspection at the United American Lines pier 86, North River, at the foot of 46th street, from November 4 to 9, inclusive.

Program of "American Marine Week"

Saturday, November 4

OPENING DAY

4:00 P. M. Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

8:00 P. M. Formal opening of "Second Annual Marine Exposition" and "AMERICAN MARINE WEEK" under the auspices of the American Marine Association.

8:05 P. M. Address by Colonel E. A. Simmons, president, American Marine Association.

8:15 P. M. Address by Colonel Theodore Roosevelt, Assistant Secretary of the Navy.

9:00 P. M. Band Concert.

10:30 P. M. Closing Hour.

Monday, November 6

SHIP OWNERS' DAY

12:30 P. M. Public opening hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

2:00 P. M. Regular quarterly meeting, American Steamship Owners' Association, in association office, 11 Broadway, New York.

3:30 P. M. *"Ship Radio,"* by Arthur Batcheller, Chief Radio Inspector, Second District, Department of Commerce.

4:00 P. M. Official inspection of Marine Exposition, by the Technical Committee, American Steamship Owners' Association, William F. Gibbs, chairman.

NAVY NIGHT

8:30 P. M. *"The Navy,"* by Rear Admiral C. T. Vogelgesang, U. S. N.

9:00 P. M. Concert by Brooklyn Navy Yard Band.

10:30 P. M. Closing Hour.

Tuesday, November 7

NEW YORK TOW BOAT EXCHANGE DAY

12:30 P. M. Public Opening Hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

2:30 P. M. Moving Picture, *"Tow Boating in New York*

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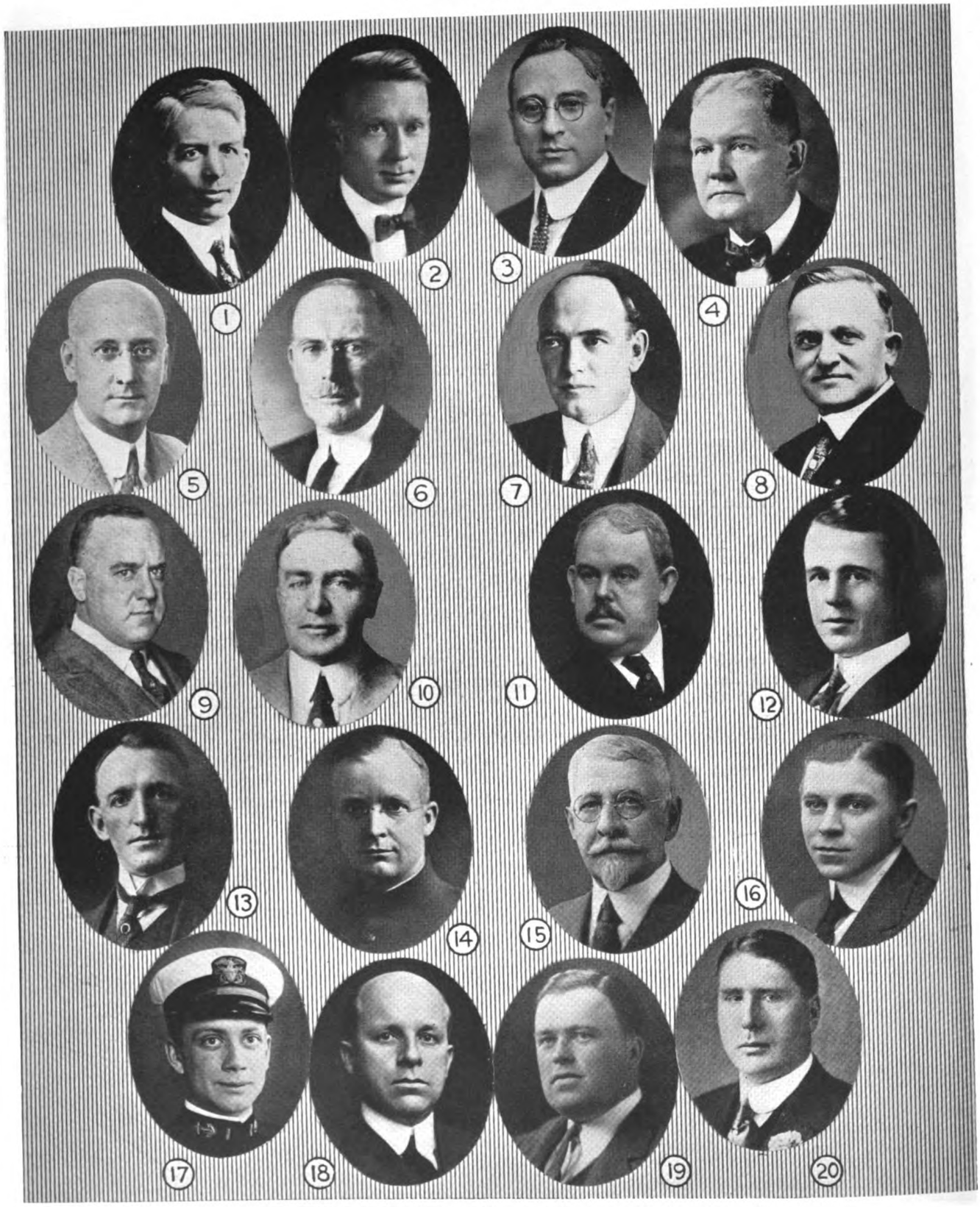

Directors and Chairmen of Committees of American Marine Association

(1) H. L. Hibbard, Cutler-Hammer Manufacturing Company, executive committee; (2) W. A. Cather, Worthington Pump and Machinery Corporation, chairman, publicity committee; (3) M. L. Katzenstein, Worthington Pump and Machinery Corporation, executive committee; (4) Capt. W. H. Stayton, Baltimore Steamship Company, executive committee; (5) H. W. Adams, Jr., Scovill Manufacturing Company, executive committee; (6) W. P. Smith, William Cramp and Sons Ship and Engine Building Company, executive committee; (7) F. C. Bradbury, Crane Company, executive committee; (8) J. C. McQuiston, Westinghouse Electric and Manufacturing Company, executive committee; (9) Frank Hatch, Shephard Electric Crane and Hoist Company, executive committee; (10) Gardner Cornett, Pneumercator Company, executive committee; (11) W. M. McFarland, Babcock and Wilcox Company, executive committee; (12) G. W. Selby, Marine Decking and Supply Company, executive committee; (13) H. C. Davis, Row and Davis Engineers, Inc., executive committee; (14) J. Hense, Northern Fire Apparatus Company, chairman, transportation committee; (15) W. A. Lake, Pantasote Company, chairman, entertainment committee; (16) K. W. Heinrich, Bethlehem Shipbuilding Corporation, executive committee; (17) W. S. Doxey, *Marine Review*, chairman, enrollment committee; (18) C. F. Scott, General Electric Company, executive committee; (19) Benjamin F. Neilds, Jr., National Malleable Castings Company, chairman, liaison committee; (20) H. F. Alexander, Pacific Steamship Company, executive committee.

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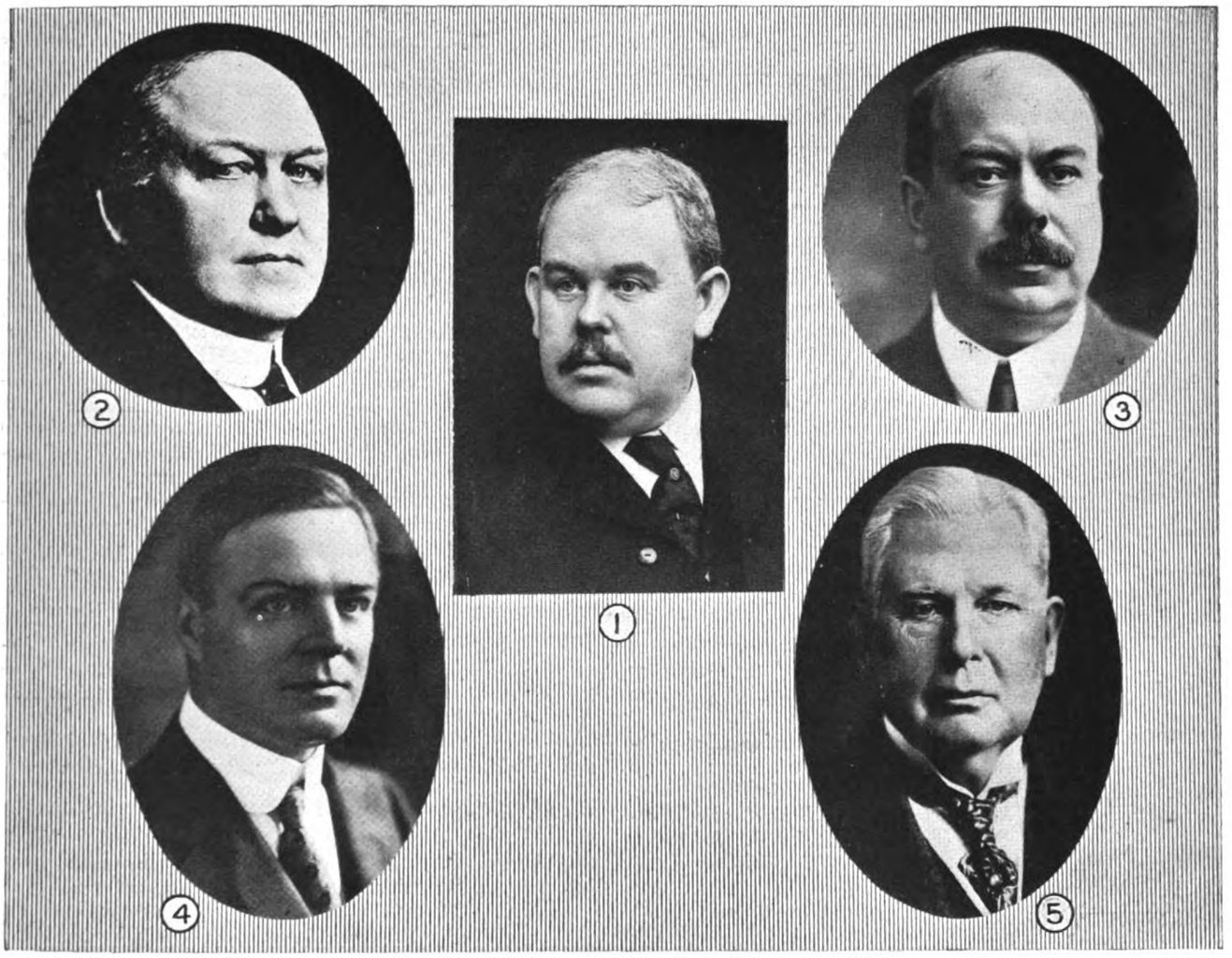

(1) Captain Walter M. McFarland, President, Society of Naval Architects and Marine Engineers; (2) H. H. Raymond, President, American Steamship Owners' Association; (3) Charles H. Potter, President, Maritime Association of the Port of New York; (4) James L. Ackerson, President, Atlantic Coast Shipbuilders' Association; (5) Stevenson Taylor, President, American Bureau of Shipping.

Harbor," specially filmed for The New York Tow Boat Exchange, Auditorium, second floor, Exposition Hall.

3:00 P. M. Meeting of the Council of the Society of Naval Architects and Marine Engineers, Room 1101, Engineering Societies' Building, 29 West 39th street, New York, N. Y.

OCEAN OFFICERS' NIGHT

8:00 to 10:30 P. M. National election returns broadcasted at 412 meters, by the Anacostia, D. C., station.

8:00 P. M. Smoker for masters, mates, pilots, engineers and radio telegraphers under the auspices of Ocean Officers' Conference, Auditorium, second floor, Exposition Hall.

10:30 P. M. Closing Hour.

Wednesday, November 8

NAVAL ARCHITECTS' AND MARINE ENGINEERS' DAY

9:00 A. M. Private opening hour for members of the Society of Naval Architects and Marine Engineers.

10:00 A. M. Opening Technical Session of the Society of Naval Architects and Marine Engineers, President W. M. McFarland, presiding, Auditorium, second floor, Exposition Hall.

The following is the list of papers to be read and discussed at the Wednesday meetings:

1. *"Automatic Steering,"* by Elmer A. Sperry, Member.
2. *"Details of Naval Design from Jutland,"* by Commander Herbert S. Howard, C. C., U. S. N., Member.
3. *"The Application of Dyson's Method to Propellers of Ocean-going Merchant Vessels,"* by Edwin A. Stevens, Jr., Member.
4. *"Stresses on Vessels of the Great Lakes Due to Waves of Varying Lengths and Heights,"* by Professor Herbert C. Sadler, Member of Council, and Professor Anders Lindblad, Member.
5. *"A Study of the Wake of Certain Models by Means of a Current Meter,"* by Professor Edward M. Bragg, Member.
6. *"Some Experiments on Propeller Position and Propulsive Efficiency,"* by Rear Admiral David W. Taylor, C. C., U. S. N., Honorary Vice-President.

12:30 P. M. Public Opening Hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

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SHIPPING BOARD NIGHT

8:30 to 9:30 P. M. Concert, by the Washington Navy Yard Band, broadcasted at 412 meters, by the Anacostia, D. C., station.

9:35 P. M. *"The Navy After the Limitation of Arms Conference,"* by Captain Luke McNamee, U.S.N.; broadcasted at 412 meters, by the Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Thursday, November 9

NAVAL ARCHITECTS' AND MARINE ENGINEERS' DAY

9:00 A. M. Private opening hour for members of the Society of Naval Architects and Marine Engineers.

10:00 A. M. Second Day Technical Sessions of the Society of Naval Architects and Marine Engineers, President W. M. McFarland, presiding, Auditorium, second floor, Exposition Hall.

The following is the list of papers to be read and discussed at the Thursday meetings:

7. *"Efficiency in the Operation of Steamships,"* by Captain Daniel A. J. Sullivan.
8. *"A Sixteen Hundred and Fifty Horsepower Gasoline Fire Boat,"* by Arthur D. Stevens.
9. *"The Longitudinal Strength of Rigid Airships,"* by Professor William Hovgaard.
10. *"Machinery and Trials of the Passenger Ships—American Legion Class,"* by Robert Warriner, Member.
11. *"Standardization as Affecting the Shipbuilding Industry in the United States,"* by Ernest H. Rigg, Member of Council.
12. *"The Selection of the Best Kind of Propelling Machinery,"* by James L. Ackerson, Member.

12:30 P. M. Public Opening Hour.
Registration of delegates at Registration Booth in Main Lobby, Grand Central Palace, 46th street and Lexington avenue, New York, N. Y.

7:00 P. M. Reception at Waldorf-Astoria, 34th street and Fifth avenue, New York, N. Y., for members and guests of the Society of Naval Architects and Marine Engineers.

7:30 P. M. *"Ship Radio,"* by Arthur Batcheller, Chief Radio Inspector, Second District.

8:00 P. M. President Warren G. Harding's Message, delivered by The Hon. Edwin H. Denby, secretary of the Navy, at banquet of the Society of Naval Architects and Marine Engineers.

8:30 P. M. Address by Admiral R. E. Coontz, Chief of Naval Operations, U. S. N., broadcasted at 412 meters, by the Anacostia, D. C., station.

9:05 P. M. *"Navy Personnel,"* by Rear Admiral Thomas Washington, Chief of the Bureau of Navigation, U. S. N., broadcasted at 412 meters, by the Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Friday, November 10

DEPARTMENT OF COMMERCE DAY

10:00 A. M. Annual meeting and election of officers of the American Marine Association, Auditorium, second floor, Exposition Hall.

Order of Business:

1. Reading of minutes of preceding meeting.
2. Report of Executive Committee.
3. General business.
4. Reports from district meetings of elections of members to Executive Committee.
5. Election of officers.

11:30 A. M. "Informal Conference on Standardization of Shipbuilding Equipment," under the auspices of the American Marine Association and The Department of Commerce, Auditorium, second floor, Exposition Hall.

12:30 P. M. Public Opening Hour.

2:30 P. M. Maritime Conference, Auditorium, second floor, Exposition Hall.

Speakers:

1. *"Duties of the Coast Guard,"* by Commander B. L. Reed, U. S. C. G.
2. *"The Lighthouse System of New York Harbor and the U. S. Coast Line, and Recent Improvements,"* by Geo. R. Putnam, Commissioner of Lighthouses, Department of Commerce. Illustrated by moving pictures.
3. *"The Relation of the Merchant Marine to Business,"* by Francis H. Sisson, Vice-President, Guaranty Trust Company.
4. *"Fuel Economy in Shipping Board Vessels,"* by Commander R. D. Gatewood, Director Division of Maintenance and Repair, United States Shipping Board.

NATIONAL MERCHANT MARINE ASSOCIATION NIGHT

8:00 P. M. *"The Merchant Marine as a National Defense,"* by Captain William H. Stayton, President, Baltimore Steamship Company, Speakers' Forum, Exposition Hall.

8:30 to 9:30 P. M. Concert, by the Washington Navy Yard Band, broadcasted at 412 meters, by the Anacostia, D. C., station.

8:30 P. M. Motion picture, *"Tow Boating in New York Harbor,"* specially filmed for the New York Tow Boat Exchange, Auditorium, second floor, Exposition Hall.

9:35 P. M. *"What the Navy Does for Your Business and What It Costs You,"* by Captain L. M. Overstreet, U. S. N., broadcasted at 412 meters, by the Anacostia, D. C., station.

10:30 P. M. Closing Hour.

Saturday, November 11

MARITIME ASSOCIATION DAY

12:30 P. M. Public Opening Hour.

2:30 P. M. Maritime Conference, Auditorium, second floor, Exposition Hall.

1. *"The Value of the Tramp Steamship,"* by Chas. H. Potter, President, Maritime Association of the Port of New York.
2. Address, by Winthrop L. Marvin, Vice-President and General Manager, American Steamship Owners' Association.
3. *"The Ocean Officers,"* by Captain John F. Milliken, Secretary-Treasurer, Neptune Association.
4. *"Efficiency of Personnel,"* by Captain Reginald Fay, President, National Board Steam Navigation.

ARMISTICE NIGHT

8:30 P. M. *"Engineering and the Navy,"* by Rear Admiral J. K. Robison, Engineer-in-Chief, U. S. N., broadcasted at 412 meters, by Anacostia, D. C., station.

9:00 P. M. *"The Naval Air Service,"* by Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics, U. S. N., broadcasted at 412 meters, by Anacostia, D. C., station.

10:30 P. M. Closing Hour.

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Directory of Exhibits at the Marine Exposition

Adams and Westlake Company, Philadelphia, Pa.—Joiner hardware, drapery hardware, furniture hardware, parcel racks, book racks, notice plates, sash locks, deck storm windows, electric fixtures for general superstructure lighting, including ceiling, wall and berth lights. Representatives: E. L. Langworthy, E. H. Stearns, C. S. Heller, H. Seip. Booth 75-A.

The Admiral Line, 17 State Street, New York.—Large outline map of the United States on which will be shown five trans-Continental railroad routes to the Pacific coast featuring the Admiral Line passenger service between Seattle, Victoria, Portland, San Francisco, Los Angeles and San Diego; in conjunction with the United States Shipping Board will present the Admiral Line trans-Pacific passenger service between Seattle and Victoria and Yokohama, Kobe, Shanghai, Hong Kong and Manila. Representatives, H. W. Rose, R. A. Wabraushek, A. C. Jones. Booth 311.

American Balsa Company, Inc., 305 Vernon Avenue, Long Island City, N. Y.—Ten-foot by 35-foot section of a ship's deck upon which is installed a set of Welin quadrant davits; a 26-foot steel nesting type lifeboat of the 1A class and a 26-foot steel standard 1A lifeboat chocked and nested between the davits as on board ship; Mills lifeboat releasing gear; Welin non-toppling blocks; Welin electric power winch. Representatives: H. F. Sailor, J. D. Andrew, Lewis Tanning. Booth 92.

American Car and Foundry Company, 165 Broadway, New York.—No. 3 two-electrode Berwick electric rivet heater; No. 3 one-electrode type "E" Berwick heater; 4-foot Berwick rod heater. Representatives: F. C. Cheston, W. M. Earl, J. S. Helt, D. B. Wallace. Booth 49-A.

American Engineering Company, Philadelphia, Pa.—Electric gypsy windlass. Representative: P. E. Kelly. Booth 89-B.

American Manganese Bronze Company, Homesburg, Pa.—A large bronze propeller blade; a medium sized solid propeller wheel of bronze polished; a demonstration of the ductility of the company's bronze as compared with iron and steel; test charts and photographs of installations of propeller wheels. Representatives: T. H. Addie, M. C. R. Spare, Mr. Nelson. Booth 2.

American Society of Marine Designers, 29 West 39th Street, New York.—Will represent the National Society at the Marine Show. Representative: C. C. Jacobson. Booths 228 and 229.

American Steel Foundries, McCormick Building, Chicago, Ill.—Models and photographs of standard types of ship's anchors, together with some views of specially interesting marine steel castings recently produced. A novel and successful improvement in the stockless anchor will also be shown. Representatives: A. Trevor Jones and J. T. Rowbottom. Booth 19.

Asbestolith Manufacturing Company, 1 Madison Avenue, New York.—Asbestolish for flooring, base, wainscoting, stair covering, etc., and for superior ship decking. Representatives: R. C. Burnside and assistants. Booth 64.

The Ashton Valve Company, 161-179 First Street, Cambridge 41, Boston, Mass.—Pop safety valves and relief valves; pressure and vacuum indicating and recording gages as well as testing outfits for gages and boiler test pumps; large steam whistles. Representatives: C. W. Buckelew, C. W. Ulrick and C. D. Motheral. Booth 21.

The Babcock & Wilcox Company, 85 Liberty Street, New York.—Full size sectional model of 4-inch merchant marine boiler; various sections of boiler parts, valves, fittings and tools; mechanical oil burners in full size mounted models; concentration indicator in operation. Representatives: J. H. King, C. W. Middleton, A. Ross Mackay, George H. Daniels, T. B. Stillman, John Coleman, E. A. Colson. Booth 42.

Beaver Tile Corporation, 442 West 42nd Street, New York.—Cork composition tile; natural cork tile for passages, lobbies, public rooms and staterooms. Representatives: Messrs. Newell, Hendrickson and Nason. Booth 43.

Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa.—Bethlehem-Weir turbo feed pump; Bethlehem-Weir reciprocating pump; complete Bethlehem (Dahl) mechanical oil burning system, including pumps, heaters, etc. Representatives: G. E. Lawrence, F. K. Steinrock, G. W. Grove, A. E. Fraser, G. H. Dillon, A. V. Reynolds. Booth 70.

Bramhall Deane Company, 261 West 36th Street, New York.—Representative: W. F. Wright. Booth 77-B.

Briggs Engineering Works, 227 24th Street, Brooklyn, N. Y.—Complete oil firing equipment. Representatives: C. N. Wheeler, H. W. Kuppinger. Booth 103.

Brunswick-Kroeschell Company, New Brunswick, N. J.—Two-ton refrigerating capacity marine type Brunswick ammonia compressor, direct connected to steam engine; ½-ton refrigerating capacity marine type Brunswick ammonia compressor, direct connected to steam engine; 2-ton refrigerating capacity marine type Kroeschell carbonic anhydride compressor, direct connected to steam engine; 1-ton refrigerating capacity marine type Brunswick ammonia compressor, direct connected to 3 horsepower electric motor; small Brunswick ammonia compressor cut down to show interior construction. Representatives: W. O. Whitney, W. Carpender, Booth 34.

Chase Metal Works, Waterbury, Conn.—Samples of all the sizes of copper tubing furnished to the S. S. *Leviathan*; Admiralty condenser tubes; Chamet bronze; brass rod; tubing, wire and sheet; a Balopticon which will explain by photographs and titles the Chase processes of making condenser tubes; new book on condenser tubes explaining their manufacture and specifications. Representatives: R. Chase, Capt. Gleason, D. K. Crampton, C. B. Smith, J. F. Giffen. Booth 90-A.

Coen Company, 50 Church Street, New York.—Oil burning equipment completely piped up ready for operation; firing fronts, including a forced draft Scotch boiler front, also a new large air register front for natural or induced draft; easy cleanable oil heaters; duplex oil strainers both for oil suction, discharge and for Diesel engine work; steam atomized burners with furnace decking for a flat flame burner, also the "Safety First" lighting torch; Type "A" burner complete with holder. Representatives: W. M. Wampler, F. Hall, H. B. Chamberlain, F. S. Harper. Booth 57.

Jas. A. Coffey Engineering Corporation, 1416 Broadway, New York.—Asphalt floors for interior and exterior decking; asphalt calking putty. Representatives: J. A. Coffey, L. Coffey, Miss Adele Eckstein. Booth 25.

The William Cramp & Sons Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pa.—A large Parsons' manganese bronze propeller, 11 feet 4 inches diameter, weighing about 12,000 pounds, this wheel being machined complete including the planing of the driving faces of the blades to a true helical surface and designed to transmit about 23,000 horsepower; complete model of the steamship *Santa Paula;* half size model of a lifeboat fitted with the Hunt releasing device; ingots of Parsons' manganese bronze, Parsons' white brass and Cramp's Diesel engine babbitt; Parsons' manganese bronze welding rods, Cramp's aluminum solder and Cramp's cast iron solder; spiral gear wheels of Cramp's super-strength bronze for Diesel engines; framed photographs of Cramp's marine Diesel engines, Burmeister & Wain type. Representatives: Courtland D. Cramp, I. B. Ashenfelter, W. P. Smith, Carroll S. Smith, C. R. Peterson and J. C. Shaw. Booth 73.

Crandall Engineering Company, 100 Border Street, East Boston, Mass.—Demonstration model of a longitudinally-trussed floating dock and a working model of the Crandall railway dry dock together with photographs of dry docks now in operation. Representatives: R. H. Lindgren and J. Stuart Crandall. Booth 38.

Crane Company, 836 South Michigan Avenue, Chicago, Ill.—The largest brass gate valve made. Representatives: G. E. Barker, E. Morgenthal, T. H. Ireland, J. C. Cole, F. C. Bradbury. Booth 68.

Crane Packing Company, 59 Park Place, New York.—"John Crane" flexible metallic packings, superheat packings, metal-

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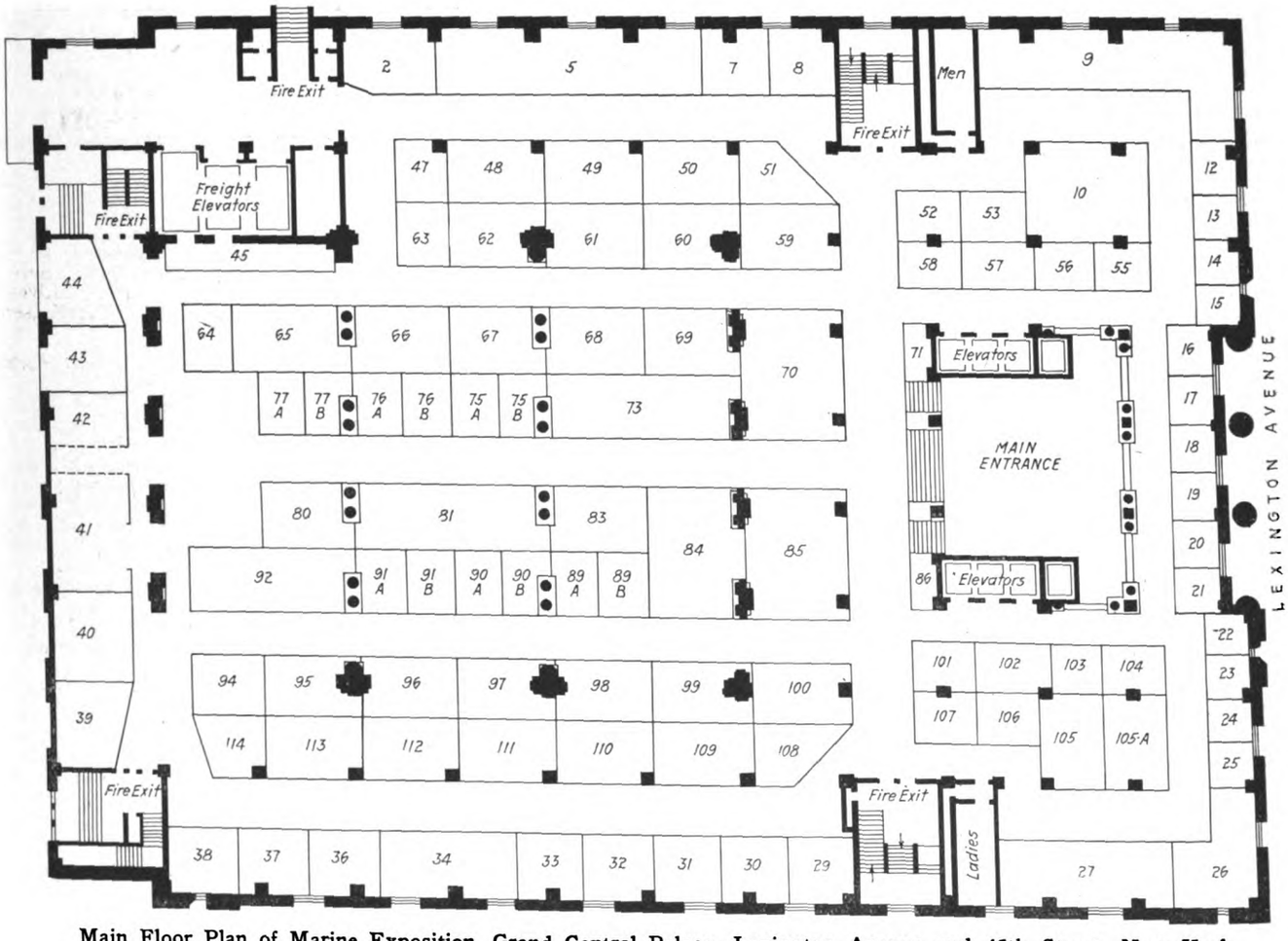

Main Floor Plan of Marine Exposition, Grand Central Palace, Lexington Avenue and 46th Street, New York

lic condenser packing. Representatives: J. N. Walton, E. M. Roberts, C. W. Bryden. Booth 304.

Department of Commerce, Washington, D. C.—*Foreign and Domestic Commerce*: Maps showing trend of foreign trade, etc., books, monographs, charts and other publications on foreign trade; posters. Representatives: R. E. Hutchinson, E. G. Gregg.

Bureau of Standards—The principal exhibit of the Bureau of Standards will be that of radio equipment, which will give an excellent example of the Bureau's development work. The Bureau will also exhibit its fog signal model and a collection of publications of direct concern to maritime interests.

Lighthouse Service: Flashing lens, illuminating and revolving, as in service; fog signal automatic siren and horn; lens lantern; post lantern; electric clock and flasher; lighthouse Service pennant; radio fog signal system; radio compass for use with radio fog signal; radio fog signal chart; charts of New York harbor. Representatives: J. T. Yates and assistants.

Bureau of Navigation—A complete ship radio installation, Kolster decremeter and other instruments used in connection with the inspection of radio stations, and the omnigraph used in connection with the examining of operators; if possible, arrangements will be made to examine applicants for radio licenses at the booth; if not, Mr. Arthur Batcheller, Radio Inspector, who will be in charge of the exhibit, will arrange for the examination of applicants at the Custom House, New York. Representative: W. D. Terrell.

Coast and Geodetic Survey—A complete set of charts, over 600 in number, covering the territorial waters of the Atlantic, Pacific and Gulf coasts of the United States, Porto Rico, Hawaii, Panama, Virgin Islands, Guam and the Philippines, a total length of shore-line in excess of 100,000 miles; fifteen volumes of sailing directions, or coast pilots, for all the coastal and inside routes covered by the coast survey charts, "Tide and Current Tables," for all navigable tidal waters and for all currents in territorial waters; special publications on miscellaneous subjects related to navigation; diagrams and photographs illustrating methods and results of the survey's operations. Representative: R. L. Faris.

Steamboat Inspection Service: Shoulder line carrying gun with full equipment; twenty-two-foot lifeboat with full equipment for ocean service; set of turning out davits for lifeboat; model of Engelhardt lifeboat; model of catamaran life raft; model of Carley life float; adult life preserver for ocean service; adult life preserver for river and harbor service; child life preserver; life preserver in section; line carrying gun with full equipment; cork ring buoy with water light; ring buoy not covered; American fire tank containing liquid and buckets; soda and acid fire extinguisher; soda and acid fire extinguisher, sectional; deep sea sounding machine; section of hose with nozzle, gage and relief valve; dead weight gage tester; air pump and gage for testing air tanks of lifeboats; set of steel stamps for stamping boiler plate; micrometer for calipering boiler plate; set of steel test coupons; set of welding coupons; each of license forms; detecting and control cabinet for fire; safety valve, sectional; fog horn, mechanical; fusible plugs. Representative: F. P. Noel. Booth 210.

Diamond Power Specialty Corporation, Detroit, Mich.—Display of two new types of marine soot blowers, Model BBM for Scotch marine boilers and Model G-2 M for use with revolving soot blower elements on marine watertube boilers; working models of its Model B rear end blower for Scotch marine boilers and of its Model G-2 and Valve-in-Head soot blowers for watertube boilers. Representatives: L. W. Nones, A. W. Homan and Mr. Crawford of New York and Robert June of Detroit. Booth 63.

O. M. Edwards Company, Inc., Syracuse, N. Y.—Window balances, locks and anti-rattling devices for sash; interior steel furniture and trim. Representatives: E. F. Chaffee, Harold Edwards, J. J. Edwards, A. J. Horgan. Booth 56.

Ehret Magnesia Manufacturing Company, Valley Forge, Pa.—Ehret's 85 percent magnesia pipe and boiler coverings, 85 percent magnesia plastic, powdered magnesium carbonate. Representatives: R. F. Leonard, A. A. Pfeiffer, J. W. Quinn. Booth 75-B.

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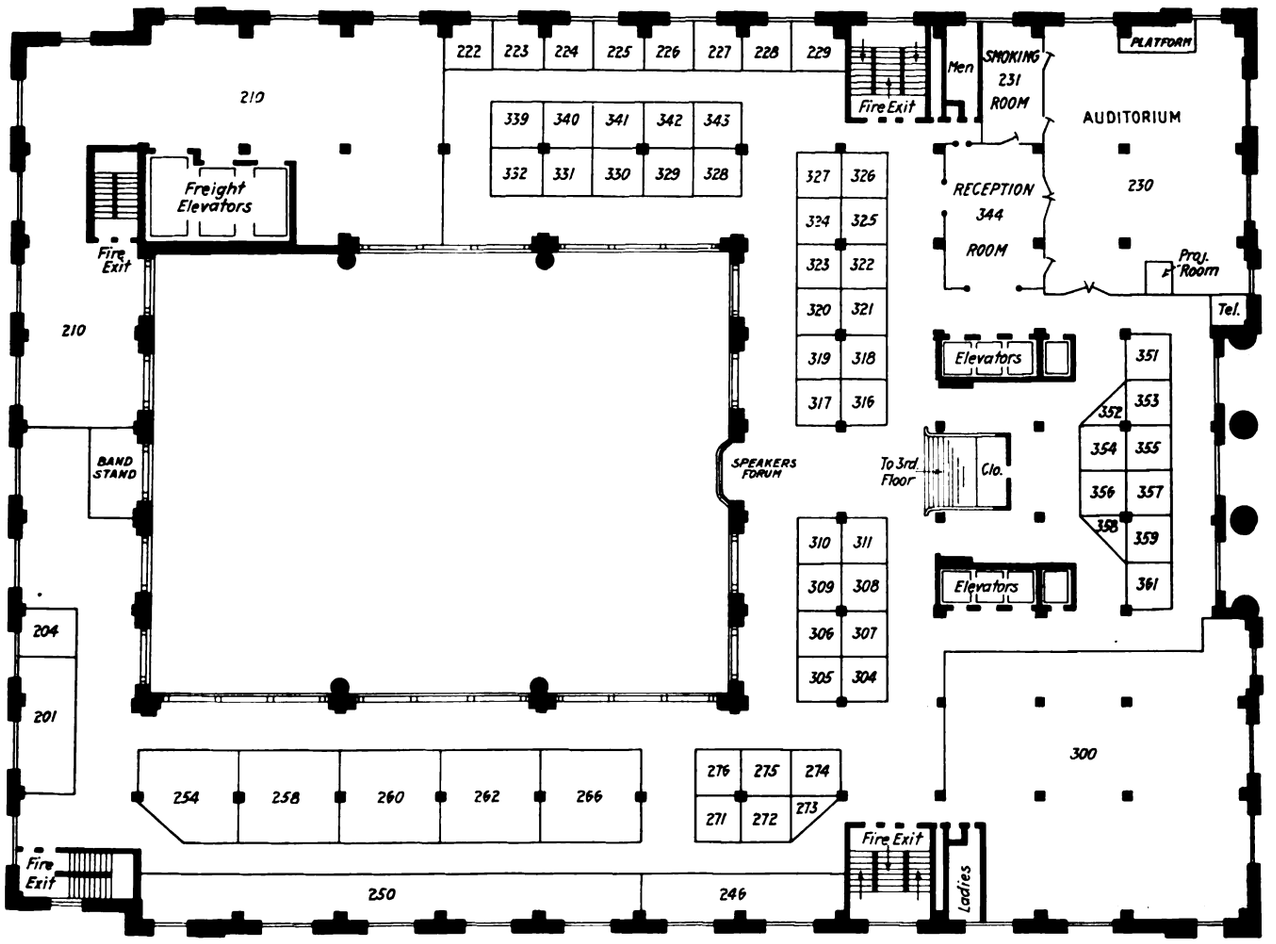

Mezzanine Floor Plan of Marine Exposition, Grand Central Palace, Lexington Avenue and 46th Street, New York

Electric Storage Battery Company, 18th and Allegheny Avenues, Philadelphia, Pa.—Exide batteries for marine service; wireless, lighting, gyroscope and compass service, motor boats and speed boats, and ignition; also Exide "Ironclad" batteries for industrial trucks and a complete submarine cell; complete marine wireless switchboard. Representatives: Mr. Folk, Mr. Gay, Mr. Fuller, Mr. Wright, Mr. Kulberg, and Mr. Norris. Booth 356.

The Ellcon Company, 50 Church Street, New York.—White porcelain enameled stanchions; Aero metal fittings; window curtains and fixtures for passenger vessels; ball bearing door hangers; flexible reinforced metal hose for oil burning vessels; ladder for engine and fireroom gratings fitted with safety step treads to prevent slipping. Representatives: W. M. Wampler, G. H. Ord, C. A. Koenig. Booth 53.

Exeter Machine Works, 30 Church Street, New York.—Rotary pumps suitable for the following marine service: Cargo, ballast, fuel oil transfer, lubricating oil, sanitary and fresh water. Representative: C. G. Holmquist. Booth 77-A.

Fire Detecting Wire Corporation, 2 West 45th Street, New York.—Automatic fire alarm apparatus. Representatives: C. Van Zandt, C. Peterson. Booth 276.

Foster Marine Boiler Corporation, 111 Broadway, New York.—Catalogs and test data describing the operation of the Foster marine boiler on over 135 ships; also literature describing the new Foster marine economizer which is the latest development in fuel conservation for marine boilers. Representatives: J. J. Nelis and John Kilfeather. Booth 106-A.

General Electric Company, Schenectady, N. Y.—The rotating element of a 3,000 horsepower reduction gear, less the low speed gear, such as is used in ships equipped with geared turbine drive; model of the low speed gear and an actual spring thrust bearing used in propulsion service; control panels built for the Golden Gate line of Diesel engine electric ferryboats and the turbine electric boats for the San Francisco-Oakland line in San Francisco harbor; motors for driving ship's auxiliary apparatus; 10 kilowatt steam engine driven generating set and control panel; searchlights; complete arc welding outfit in operation. Representatives: W. J. Day, E. K. Henley, C. H. Giroux, G. E. Young, W. J. Belanger. Booth 5.

Gimbel Brothers, 33rd Street, New York.—China, glass, silverware, linens, sheets, pillow cases, towels, blankets, steamer chairs, books and other items to be furnished under contract to the S. S. *Leviathan* Representatives: E. F. Quinn, J. J. Matthews, J. J. Lynch. Booth 83.

Griscom-Russell Company, 90 West Street, New York.—Reilly submerged type evaporator, self-scaling; G-R automatic feeder which maintains a constant water level in the evaporator shell; the G-R automatic vapor pressure control valve; the special G-R drainer for keeping the coils clear of water, as well as the other standard fittings; G-R type C expansion joint. Representatives: R. Colston and A. R. Hoffman. Booth 60.

Hooven-Owens-Rentschler Company, Hamilton, Ohio.—Hamilton Damara piston rings; marine engine parts; pictures of the various Hamilton marine engines; views of the plant and of ships driven by Hamilton marine engines. Representatives: G. A. Rentschler, Jr., H. Greger, H. A. Smith, F. L. Hummel. Booth 18.

Hyde Windlass Company, Bath, Maine.—Electric steering gear in operation; electric telemotor recently perfected. Representatives: R. E. Ross, F. L. Andrews, C. E. Paine. Booth 33.

International Nickel Company, 67 Wall Street, New York.—Monel metal and nickel in basic and commercial forms; power plant applications; various applications to marine uses. Representatives: G. A. Wotherspoon, E. A. Turner, A. Muller-Thyme. Booth 76-B.

Keasbey & Mattison Company, Ambler, Pa.—Working steam coil with various types of insulating materials applied and suitable instruments on these to show the actual cutting down in temperature by the use of these insulations; charts will show the actual saving in B. T. U. through the use of

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the several grades of insulation. Representative: L. L. Barrett. Booth 47.

Kingsbury Machine Works, 4320 Lackawanna Street, Frankford, Philadelphia, Pa.—Kingsbury thrust bearings (six exhibits): self-lubricating bearings of two types; turbine bearings; large equalizing bearing; air-lubricated bearing; thrust shoe for United States airplane carrier (largest yet built). Representatives: A. Kingsbury, H. A. S. Howarth, W. T. Holman, Nelson Ogden. Booth 101.

Lee & Simmons, Inc., 44 Whitehall Street, New York.—Models of barges used in the transportation business in the port of New York; models and pictures showing the evolution from the old sail lighter to the barges of the present day. Representatives: D. T. Lamond, G. J. Lutz, R. O. Wilson, C. C. Miller, J. P. Heuer, W. G. Conners, H. F. Carls. Booth 31.

Leviathan Model.—Booths 81 and 82.

Luckenbach Steamship Company, 44 Whitehall Street, New York.—Representative: A. B. Townsend. Booth 316.

Lunkenheimer Company, Cincinnati, Ohio.—Valves, lubricators, oil cups, grease cups, whistles, boiler mountings and similar engineering specialties; the line of valves consists of one for practically any purpose and made of either bronze, iron, steel or a special alloy. Representatives: W. A. Reynolds, J. E. Cooper, H. Burger. Booth 99.

Marine Decking & Supply Company, 116 North Delaware Avenue, Philadelphia, Pa.—American Lit-O-Sil-O decking; American Lit-O-Sil-O flooring; Madesco tackle blocks, sheaves, shackles, etc. Representatives: W. L. Peebles, J. S. Tyler, E. P. Jewell and G. W. Selby. Booth 96.

Marine Engineering and Shipping Age, Woolworth Building, New York.—MARINE ENGINEERING AND SHIPPING AGE. *The Boiler Maker*, "Shipbuilding Cyclopedia," "Practical Marine Engineering," "Laying Out for Boiler Makers" and marine books. Representatives: Colonel E. A. Simmons, Henry Lee, C. R. Mills, R. V. Wright, George Slate, F. B. Webster, H. H. Brown, L. S. Blodgett, W. Z. Gardner, H. B. Bolander, J. A. Miller, B. L. Dombrowski, R. F. Duysters, N. C. B. Fowles, J. E. Anderson. Booth 51.

Marine Works, Inc., 31 Coenties Slip, New York.—Marine kitchen and pantry outfits; sundry labor saving machines for food service; crockery; glassware, etc. Representative H. Cunningham. Booth 204.

Maritime Association of the Port of New York, 78 Broad Street, New York.—Bureau of information from a direct wire from the Maritime Exchange, giving complete news of ship disasters, sailings, movements of vessels in New York harbor and principal ports in the world; reproduction of bulletin board used on the exchange, giving entrances and clearances from the port of New York; numerous ship models. Representative: H. J. Mostyn. Booth 225.

Mercantile Specialty Company, 11 Broadway, New York.—Smithson safety porthole, smoke indicator and fuel economizer; the Keesey bridge and engine telegraph. Representative: H. G. Mullen. Booths 306 and 307.

Munson Steamship Line, 67 Wall Street, New York.—Pictures, posters, literature and reproduction of the interior of a steamer. Booth on second floor with Shipping Board exhibit.

Mustor Manufacturing Company, Grand Central Terminal, New York.—Interlocking rubber tiling; corrugated and perforated rubber mats and matting; patented oval split core and flap ring packings; high pressure sheet packings; pump valves. Representatives: G. F. Mustor, Walter S. Mustor. Booth 46-A.

National Merchant Marine Association, Washington, D. C.—Literature published by the Association. Representatives: A. H. Battey, Mr. MacDonald. Booth 311.

The National Malleable Castings Company, Cleveland, O.—Various sizes of Naco chain, shackles, both connecting and anchor, and swivels. Representative: B. Nields, Jr. Booth 58.

National Meter Company, 229 Broadway, New York.—Oil and water meters, high, low and medium pressures, for all services. Representative: G. D. MacVeagh. Booth 77-B.

Natural Carbonic Gas Company, Newark, N. J.—Cylinders containing carbonic gas—CO_2, for refrigerating purposes. Representatives: T. P. Arnold, P. E. Fay and C. A. Nichols. Booth 305.

Nautical Gazette, 20 Vesey Street, New York.—*Nautical Gazette* and various shipping books. Representatives: J. F. Loe. Booth 350.

Newport News Shipbuilding & Dry Dock Company, Newport News, Va.—Pictures illustrating the development of the plant; model of the S. S. *Leviathan* which is being reconditioned by the Newport News Company is to be located in an adjacent booth. Representative: J. P. Kiesecker. Booth 80.

New Process Chemical Company, 114 Liberty Street, New York.—Marine glue; anti-corrosive paint; anti-fouling paint; canvas paint; copper paint; tri-bituma coatings; linoleum cement. Representatives: A. Schlueter, L. Strawser, W. Gutterson, M. E. Granier. Booth 342.

New York Journal of Commerce.—Representative: P. Moneypenny. Booth 310.

New York Marine News Company, 26 Water Street, New York.—*The Marine News.* Representatives: H. J. Harding, A. H. Addoms, H. Palmer, T. Olsen, G. Weiss, C. Files and G. F. Howell. Booth 86.

New York Tow Boat Exchange, 11 Moore Street, New York.—Will demonstrate facts about the towing industry; models of tow boats; a motion picture of the towing industry entitled "Full Speed Ahead." Representative: C. A. Mason. Booth 343.

New York Tribune.—Booth 317.

Northern Fire Apparatus Company, Minneapolis, Minn.—New cargo pumps; fuel oil service and transfer units demonstrated in operation, driven by well-known standard types of marine motors; illustrations of Northern rotary pumps on bilge, sanitary, fire-protection and fresh water duties in marine and shore service. Representative: J. A. Hense. Booth 55.

Pacific Mail Steamship Company.—Exhibit in conjunction with U. S. Shipping Board. Booth Oriental in decorations. Representative: J. P. Sutherland. Booth 266.

Pantasote Company, 11 Broadway, New York.—Vehisote standard panel board for all joiner work; Pantasote leather for seats, curtains and all upholstery; partial cabin showing construction of ceilings and bulkheads. Representative W. A. Lake. Booth 30.

Peabody Engineering Corporation, 110 East 42nd Street, New York.—Peabody-Fisher wide range mechanical burner; Peabody draft gage; standard burner and air register, so mounted as to show all connections and the method of attaching this register to the boiler front without the use of any special burner tile, using instead ordinary arch brick. Representatives: J. P. Leask, E. B. Sadtler, R. I. Condon, E. L. Delafield. Booth 15.

Penton Publishing Company, Cleveland, O.—*The Marine Review.* Representatives: A. O. Backert, R. V. Sawhill, W. S. Doxsey, F. V. Cole, Joseph Fuller, A. H. Jansson. Booth 32.

Pioneer Company, 25 Broad Street, New York.—Various types of metallic packing for steam engines in full size models. Representatives: G. Thiessen, G. W. Jenson, Mr. McDonough. Booth 273.

Pneumercator Company, 40 Flatbush Avenue, Brooklyn, N. Y.—Pneumercator tank gages, ship's draft gage, distant boiler gage glass (the latter, located in the engine room or chief's office will reproduce in full size the boiler gage glass enabling the officer on watch to know at all times the height of water in the boiler). Representatives: G. Cornett, H. S. Parks, W. Thomas. Booth 8.

Port of New York Publicity, 5 Beekman Street, New York. Representative: A. R. Arnheim. Booth 46.

Power Specialty Company, 11 Broadway, New York.—Foster superheater. Representatives: J. J. Nelis, John Kilfeather. Booth 106-B.

Roto Company, Hartford, Conn.—Tube cleaners for Scotch marine watertube and firetube boilers; condenser cleaning apparatus; plate and hand hole scrapers. Representatives: J. V. Doherty, W. R. Van Nortwick, W. M. Kelley. Booth 352.

Row & Davis Engineers, Inc., 90 West Street, New York.—Paracoil evaporator, feed water heater, oil heater, water still; RanD system for reliquefying bunker oil without steam coils in the double bottom tanks. Representatives: R. R. Row, H. C. Davis and Messrs. Thompson and W. Young. Booth 65.

Scovill Manufacturing Company, Waterbury, Conn.—Brass mill products and manufactured articles; seamless tubing, sheet metal, rods and wire made from brass, bronze and nickel silver besides a representative collection of manufactured articles; Scovill condenser tubing; numerous slides will illustrate how the Admiralty mixture condenser tubing is

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made; exhibit of metallographic microscope and numerous specimens of metal; samples of corroded condenser tubing; Admiralty condenser tubing; booklet on tube manufacture. Representatives: Philip Davidson, E. L. Carter, C. A. Gleason, M. L. Sperry, Jr., L. L. Williams and E. H. Callanan. Booth 59.

Shipping, 82 Beaver Street, New York.—Representatives: John Collins, Peter Bain. Booth 358.

Sperry Gyroscope Company, Brooklyn, N. Y.—Gyro compass; helm angle indicator; ship stabilizer model; high intensity searchlight; "mechanical quartermaster" (simplified gyro compass). Representatives: R. B. Lea, Messrs. Whitaker, Conover, Jobson. Booths 22, 23 and 24.

The Stamford Foundry Company, 117-149 Canal Street, Stamford, Conn.—Shipmate ranges in various sizes; Oxo kerosene burner. Representative: F. W. Brant. Booth 327.

Sterling Cooper Corporation, 220 West 42nd Street, New York.—Sterling's Marine Catalog and other publications. Representatives: F. W. Sterling, T. G. Newbery, E. Zahn, G. P. Nightingale. Booth 71.

B. F. Sturtevant Company, Hyde Park, Boston, Mass.—Forced draft unit; 5 kilowatt gasolene engine generating set; steam turbine; electric driven ventilating sets; 75 horsepower gasolene propulsion engine. Representatives: E. B. Williams, E. L. Moran. Booth 111.

Submarine Signal Company, Boston 9, Mass.—Submarine pneumatic bell; Fessenden oscillator. Representatives: W. L. Gifford and E. P. Howe. Booth 326.

The Superheater Company, 17 East 42nd Street, New York.—Model of the Elesco fire-tube superheater as applied to the Scotch marine type of boiler; model of the Elesco superheater as applied to marine watertube boilers and boilers used on river boats; steam pyrometer for measuring steam temperatures; engineering data and literature. Representatives: H. B. Oatley, G. E. Ryder, C. A. Brandt, G. C. Fuller, W. H. Lovekin, G. E. Kershaw, W. McLintock, G. L. Moore, J. A. Barnes. Booth 66.

The Texas Company, 17 Battery Place, New York.—Lubricating oils and greases for every purpose aboard ship; fuel oils for bunkers and Diesel engines of all standard makes; literature on the use of oil-burning equipment will be distributed; other technical matter will deal with the lubrication of all primary and auxiliary units including reciprocating engines, turbines, Diesel engines, ice machines, dynamos and blower engines. Representatives: F. J. Shipman, D. Perry Quinn, J. L. Ward, L. O'Malley, E. A. Lobb, H. W. Schilling, R. A. Fischer and Al. St. James. Booth 16.

W. & J. Tiebout, 118 Chambers Street, New York.—Complete assortment of marine hardware and supplies. Representatives: John Tiebout, Sr., John Tiebout, Jr., G. V. Carlin, J. D. Gillespie, F. J. Morissey, C. H. Schult. Booth 29.

P. S. Thorsen & Company, Inc., 81 Coffee Street, Brooklyn, N. Y.—All types of insulation for steam and brine work and the best method of application. Representative: M. L. Bullard. Booth 107.

Todd Shipyards Corporation, 25 Broadway, New York.—Todd fuel oil burning systems for marine and stationary practice; Todd mechanical burner; steam atomizing burner; Todd "Guardian"; Todd thermofeed regulator; differential pump governor; Elesco firetube superheater and other steam saving specialties. Representatives: H. Nightingale, G. P. Haynes, R. Payne, R. Sterling, T. Torgensen, Jr. Booth 84.

Tuco Products Corporation, 30 Church Street, New York. "Flexolith" composition flooring material shown in Pantasote Company's exhibit, Booth 30. Representatives: D. W. Pye, Walter Byrnes.

Underwood & Underwood, 6 East 39th Street, New York.—Photographic materials of all kinds. Representatives: F. Lacey, A. V. Jones, H. S. Redell. Booth 44.

United American Lines, 39 Broadway, New York.—Model 14 feet long built with unusual accuracy and detail of the S. S. *Reliance*. Representatives: H. Doblin, J. A. Lovett, J. Pannes, Charles Edwards, E. A. Winkler, James Dowd, Charles Faulkner, William Siemers, J. Jensen, W. Rehm, J. A. Pirnie, C. C. Wardlow. Booths 274 and 275.

United States Lines.—Exhibit in conjunction with the United States Shipping Board. Booth will be European in its decorations in accordance with the plan to have the Shipping Board operating companies represent in their decorations the services in which they run. Representative: E. E. McNary. Booth 258.

United States Navy, Washington, D. C.—Airplane propeller; Liberty motor; propeller for Martin-Bomber; dummy bomb, 1,000 pounds; Mark IV dummy bomb; Mark V dummy bomb; No. 230 Mark I dummy bomb; No. 520 Mark I dummy bomb; Mark III pilot directing bomb sight; 21-inch torpedo, Mark I, model 1; Mark III collapsible head for torpedo; 21-inch two-wheel torpedo truck; set of exhibition models, ⅛-inch scale, comprising the following vessels, showing the development of the vessels from the beginning of the Navy up to the present time: *Bon Homme Richard, Constitution, Enterprise, Ohio, Hartford, Monitor, Merrimac, Benton, Chicago, Brooklyn, Oregon, T. B. Winslow*, torpedo boat destroyer, dreadnaught, battle cruiser, scout cruiser, submarine, *N. C. 4*.

Exhibition models, Frigate *Vermont*, destroyer *Sampson*, submarine *S-3, Oklahoma, Connecticut, Pennsylvania*.

Range finder, Mark XI, with carriage and tripod; Mark VI mine outfit complete; telescope; stadimeter; Colt machine gun; Lewis machine gun; 3-inch dummy cartridges; 1 pounder dummy cartridge; 3 pounder dummy cartridge; 6 pounder dummy cartridge; 3"/23 dummy cartridge; 4"/50 dummy cartridge; 5" projectile, target; 6" projectile, target; 8" projectile, target; 12" projectile, target; 14" projectile, target; 16" projectile, target; 5"/51 charge, dummy; 6" charge, dummy; 8" charge, dummy; 12" charge, dummy; 14" charge, dummy; 16" charge, dummy; 5" to 14" powder tanks.

Three-inch anti aircraft gun; loud speaking radio transmitting and receiving set. Paintings showing heroic deeds of men in Navy and Marine Corps during the world war. Booths on second floor.

United States Shipping Board, Washington, D. C.—Reproduction of a suite of rooms from the "535" type of vessel; each of the four operating lines will have their own booths which will be suitably decorated according to the service in which they run. Representatives: E. E. MacNary, F. W. Wolf, J. P. Sutherland, T. J. Kehoe. Booth 250.

Valentine & Company, 456 Fourth Avenue, New York.—Valspar, Valspar varnish-stains, Valspar enamels. Representative: Dorning Walker. Booth 45.

Victor Engineering Company, Harrison Building, Philadelphia, Pa.—Victor marine ash ejector (without a pump) in full size, showing rearrangement of operating mechanism so that lower part is removed entirely into the bilge, leaving nothing visible above floor; charts of steam consumption and capacities of ejector. Representatives: E. Hahn, C. L. Bachman. Booth 12.

Wager Furnace Bridge Wall Company, 108 Academy Street, New York.—The Wager patent bridge wall for Scotch and watertube boilers for marine and stationary use. Representatives: A. Halley, L. F. Fenwick. Booth 98.

Wailes Dove-Hermiston Corporation, 17 Battery Place, New York.—Samples of Bitumastic and Hermastic solution and enamel; Bitumastic colored paints, as applied to steel plates. Representative: Linden Stuart. Booth 360.

Westinghouse Electric & Manufacturing Company, 165 Broadway, New York.—Complete model of Diesel electric propelling equipment; model of Kingsbury thrust bearing; 100 kilowatt turbine generator set; marine type 1,500 shaft horsepower reduction gear and pinion; flexible frame pinion; watertight deck winch motor and control; marine gasoline electric lighting set; one of the two types of air ejectors developed for marine use, Navy type circuit breakers, marine type bracket fans, and other examples of supply apparatus. Representatives: C. C. MacMillan, H. Peterson, H. L. McCarter, W. B. Bassett, H. W. Loren, R. D. Aldridge, C. M. Brown, R. M. Davis, L. E. Howell, N. R. Sibley, T. A. Fensenig, W. H. Easton. Booth 85.

C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, Pa.—Vacuum pumps and condensate pumps, also dynamometers for testing the horsepower of gas and Diesel engines, Radojet air pump. Representatives: C. Lang, J. Mullan and J. Dobson. Booth 7.

C. A. Woolsey Paint & Color Company, 500 Grand Street, Jersey City, N. J.—Display cards and descriptive matter showing "Adamant" deck paint, copper paint, yacht white, engine enamels, "Glisto" enamel, spar varnish, iron and steel bottom paint, steam compounds, etc. Representatives: P. Varley, Arthur Scott, E. D. Kelly, A. F. Hahn, F. T. Myer. Booth 13.

Worthington Pump and Machinery Corporation, 115 Broadway, New York.—Sixty horsepower 2 cycle solid injection Diesel oil engine of the type employed for auxiliary generator driving on board ship; small pumps and similar machinery; first direct acting steam pump ever built in the world. Representatives: W. A. Cather, M. L. Katzenstein, C. B. Humphrey, I. W. Jackman, H. L. Conklin, J. J. Morch. Booth 100.

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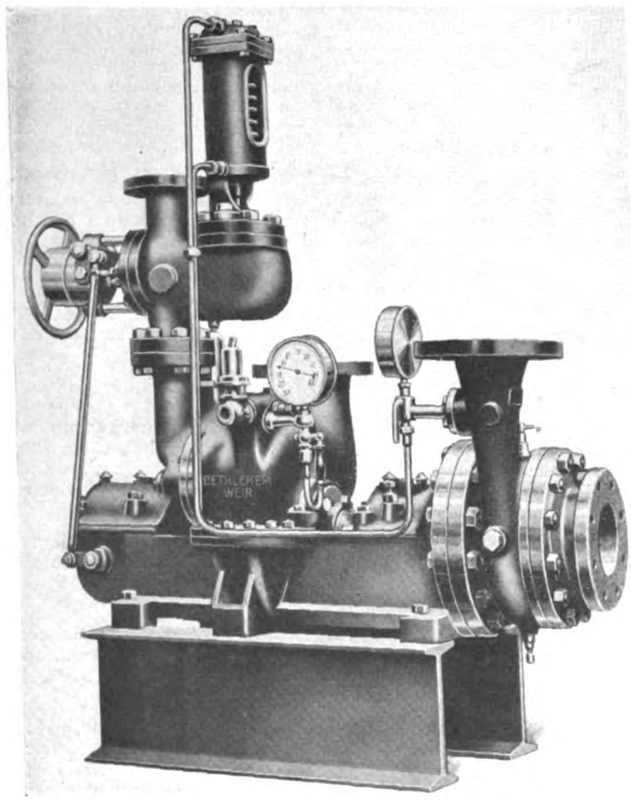
New Devices to be Exhibited at the Marine Exposition

Turbine Driven Feed Pump

THE Bethlehem-Weir turbine drive feed pump will be shown at the Marine Exposition for the first public exposition demonstration. This pump, of the type shown in the accompanying illustration, will be a feature of the Bethlehem Shipbuilding Corporation, Ltd., exhibit.

The Bethlehem-Weir turbo feed pump consists of a steam turbine of the impulse type having one pressure and several



Compact Bethlehem-Weir Turbo Feed Pump

velocity stages working in conjunction with a single stage centrifugal pump of special design. The result is a compact unit which, it is claimed, gives perfect alinement, smooth and noiseless operation and is capable of pumping a steady flow of feed water against the highest boiler pressure. Variations of boiler steam pressure and pump discharge pressure are automatically controlled by a hydraulic governor. A safety governor shuts off the steam when the speed exceeds the maximum requirements for specific operating conditions.

Safety Lifeboat Releasing Device

IN order to provide an instantaneous, safe means for releasing lifeboat falls, either under normal conditions of service or when a ship is in a sinking condition, Dr. Charles Hunt, of Washington, D. C., has invented a detaching gear for lifeboats. A special feature of the device is that a lifeboat may be released while the ship is traveling at 15 knots' speed ahead and the lifeboat is dragging through the water with the full strain on the release gear. Release is also positive even with the boat dragging with her bow 60 degrees out of water.

At the present time several sets of the releasing device are

Lifeboat Releasing Device in Closed and Open Positions

being manufactured by the William Cramp and Sons' Ship and Engine Building Company, Philadelphia, Pa., for installation in lifeboats on several U. S. Coast Guard vessels. This company controls the rights for manufacturing and selling the gear.

The gear consists of only three working parts, weighs but 15 pounds and requires but 3½ hours to make a complete installation. The body may be either a bronze or a steel casting in which are fitted a toggle jointed trip for releasing the falls, a trigger which actuates the toggle, a pulley over which the trigger line is led to the release lever and a shackle to which the boat painter may be attached. A safety lock prevents accidental release and there are no projecting parts to cause danger when handling the boat.

From the illustration the releasing action of the device is quite evident. The release lever and drum controlled by one

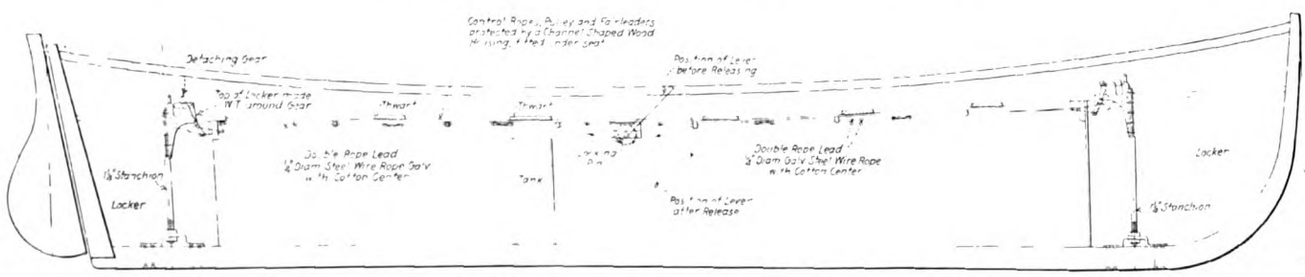


Diagram of Lifeboat Showing Hunt Releasing Equipment Installed

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man are located along the thwarts of the lifeboat and trigger lines led through pulleys to the triggers of each device. The two gears are adjusted to release simultaneously and will so function under practically any condition of stress to which the ship may be subjected.

A demonstration of the detaching gears installed on lifeboats of the S. S. *General Rucker* in May, 1922, was entirely successful and called forth recommendations from those who witnessed the demonstration. As soon as the sets of gears now under construction have been installed on boats of the Coast Guard, tests will be made by the U. S. Steamboat Inspection Service for their official approval.

Mechanical Device for Steering Ships

THE Sperry Gyroscope Company, Brooklyn, N. Y., has developed a device known as the "mechanical quartermaster," which will successfully steer ships by mechanical means alone. It is claimed that the equipment has

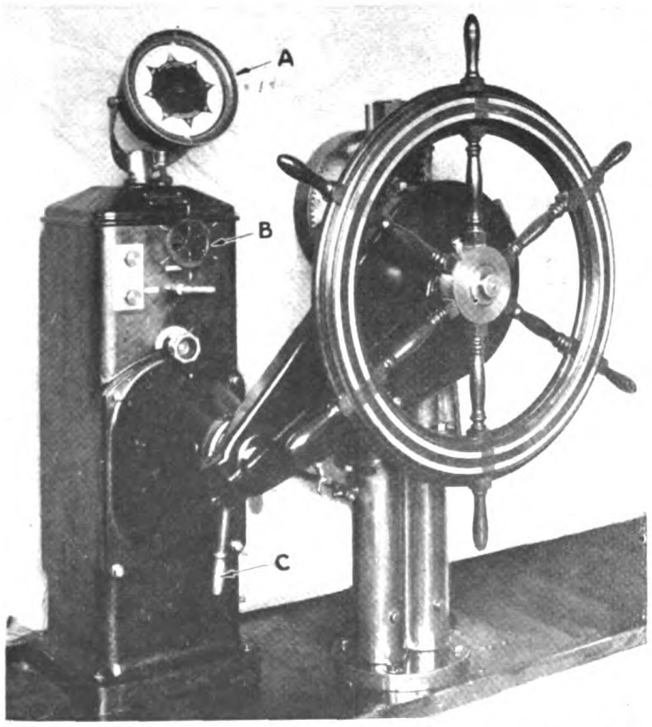


Fig. 1.—Installation of the "Mechanical Quartermaster"

steered vessels on 4,000 mile voyages, making all courses and land falls desired.

The following extract from a report made by a ship's captain to the owners indicates the success of the device: "Steered all the various courses around the Florida reefs and across the Gulf of Mexico without any variation in course. Steered a straighter course than any wheelsman could steer." This latter statement is corroborated by the sample course chart shown in Fig. 2, which indicates that while the vessel was controlled by hand the course varied to a greater extent than when under the control of the "mechanical quartermaster."

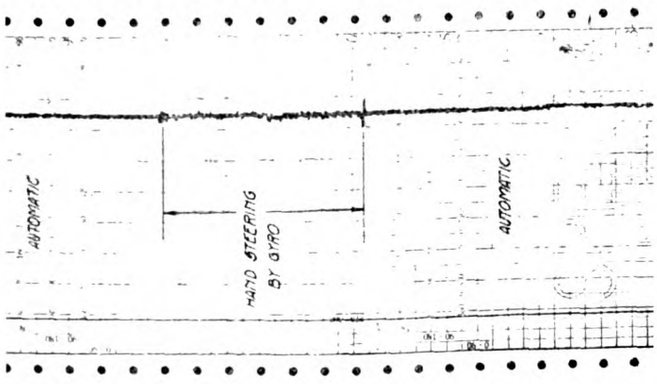


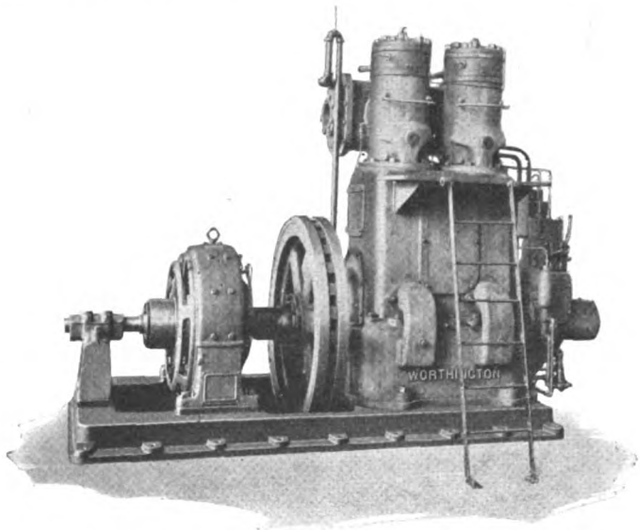
Fig. 2.—Sample Course Chart

The device has only been brought to perfection in recent months but it is the result of many years' development, work on it being halted during the late war.

The illustration of the device is shown herewith. *A* denotes the repeater compass, *B* the wheel controlling the mechanism for hand setting the desired course and *C* the clutch for disconnecting the "mechanical quartermaster" when it is desired to steer the ship by hand.

Two-Cycle Diesel Driven Generator Set

A DIESEL engine driven generator set of high efficiency for marine auxiliary current supply and emergency service has recently been developed by the Worthington Pump and Machinery Corporation, New York. The unit consists of the vertical two cylinder, two cycle type,



60-Horsepower Worthington Diesel Generator Set

solid fuel injection Worthington Diesel engine direct connected to a General Electric direct current generator. Each of the engine power cylinders has a bore of 10¼ inches and a stroke of 10½ inches. The engine develops 60 horsepower running at 375 revolutions per minute; the General Electric generator used has a rating of 40 kilowatts.

The illustration shows a complete unit which is similar to two recently ordered for the S. S. *Leviathan.* These sets are to be used for emergency service in case of accident to the main steam plant as well as for auxiliary current supply.

Insulating Quality of 85 Percent Magnesia Increased by New Process

IN the process of manufacturing 85 percent magnesia pipe and boiler coverings, the Keasbey and Mattison Company, Ambler, Pa., now uses carded asbestos fibers as the binding element. Before this time 85 percent magnesia has consisted of from 75 percent to 85 percent basic magnesium carbonate and from 15 percent to 25 percent of a relatively

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short fibered asbestos which was simply crushed and not carded.

By using the longer fiber asbestos and carding it, the required structural strength for the covering is now obtained by using 10 percent and even less asbestos. The use of the smaller percentage of asbestos permits a minimum of 90 percent basic magnesium carbonate and, since the value of insulating material is due to the cellular construction of the magnesia, which is made up of the most minute dead air cells, the resulting product insures a high insulating efficiency. The asbestos fiber itself gives little or no assistance in so far as the heat insulation is concerned, merely acting as a reinforcing constituent and binder to give the material necessary rigidity and structural strength. The manufacturers claim that increased insulating efficiencies as high as 10 percent have been demonstrated in recent tests on covering made up with the carded asbestos.

New Gyro Compass Adapted from Navy Type

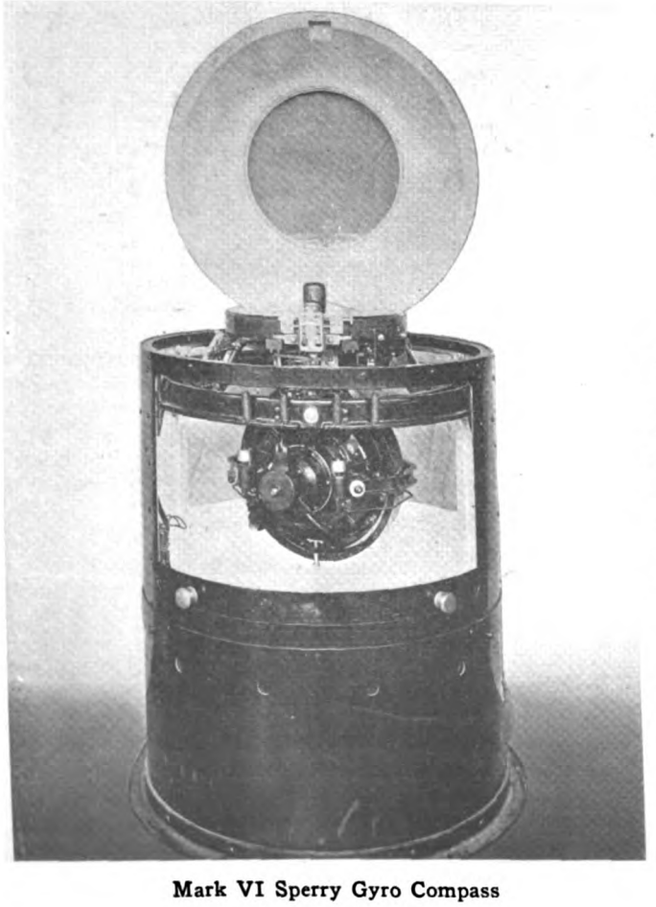
THE Mark VI gyro compass, built by the Sperry Gyroscope Company, Brooklyn, N. Y., embodies new and improved features as a result of ten years' service and experience coupled with extensive research and development work. This compass is designed after the Sperry Navy Mark V compass stripped of refinements required by the Navy for gun fire control accuracy.

The design follows the single wheel mercury ballistic type. The rotor of this compass is made of bronze, runs at the conservative speed of 6,000 revolutions per minute, weighs 59 pounds and is driven by a direct current motor operating on a current of 70 volts. The system of suspension is of exactly the same general type, although slightly modified as that in previous types of single gyro compasses. A notable feature of the compass is the fact that the card is the highest part of the compass and has no obstructions over it, giving full 360-degree visual access to the card.

The transmitter is of the commutator type and carries a lost motion device which is designed to eliminate the hunting motion of the repeaters without introducing any actual lost motion. The azimuth motor is about the size of a 1/8-horsepower fan motor, its armature being connected to the azimuth gear through one idler gear only which simplifies this part of the equipment.

The regular source of current supply for this equipment is obtained from a small half-kilowatt steam turbo generator taking steam up to 140 pounds pressure using a reducing valve and generating current at 70 volts. In addition, the compass is wired so that it can be operated from the ship's current supply through resistance.

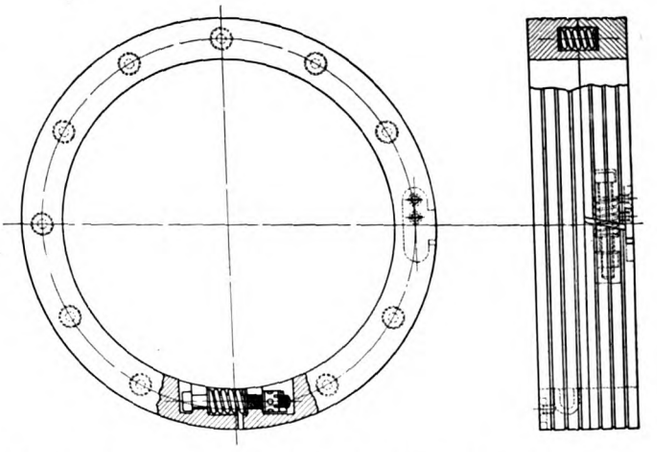
This compass will be a feature of the Sperry exhibit at the Marine Exposition.



Mark VI Sperry Gyro Compass

Piston Rings Developed for High Pressure and Superheat Service

AFTER a thorough investigation of requirements for piston rings to withstand high pressures and high degrees of superheat for marine work, the Hooven-Owens-Rentschler Company, Hamilton, Ohio, has developed the Hamilton-Damara type piston ring which can be applied to marine reciprocating engine service.



Hamilton Damara Piston Ring, Showing Bolt for Adjustment.

These rings are cast from single patterns made especially for each size ring. In the casting, care is taken to eliminate hardness, to check and control the precipitation of graphite, which process insures homogeneous ring castings and to insure uniform resiliency around the entire ring circumference.

It is stated that the Hamilton-Damara piston ring is virtually an adjustable plug piston, the adjustment being readily made by means of a machine steel bolt to which a special castellated case-hardened fine thread steel nut is fitted. In order that the required amount of tension may be obtained, a steel coil spring of special manufacture to withstand high temperatures under continuous tension is fitted to the ring in connection with this bolt and nut. To seal the top and bottom of the two rings which form the piston ring packing, a number of special steel coil springs are set in pockets between the two rings. These are clearly shown in the accompanying illustration.

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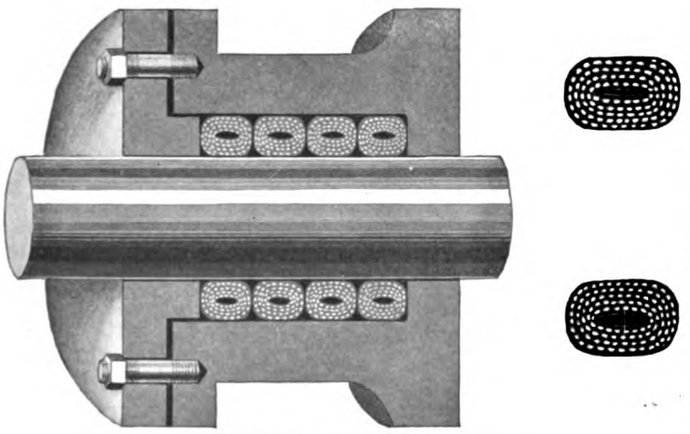
Split Core Packing Introduced in the Marine Field

VARIOUS type packings based on the air cushion principle developed by Mustor Manufacturing Company, Inc., New York, have recently been introduced in marine service.

The oval split core packing made in spiral ring or coil form in sizes 3/8-inch up by 16th's is adapted to stuffing box



Oval Type Split Core Packing

service under steam pressures as high as 150 pounds where the box is deep enough to take at least 3 rings. This packing is built of cotton duck properly frictioned together around a rubber core with rubber friction compound. The special feature is the split core which is made of soft, tough, slow ageing rubber with a split running longitudinally through its center. The accompanying illustration shows how with increasing gland pressure the expansion of the packing increases, automatically opening up an air cushion.

The cross diagonal split core packing combines the split core air cushion principle of the oval type with the well known cross diagonal packing construction. It is recommended by the company for outside and inside packed pumps, cylinder elevators and cold and hot water piston rods.

A third type packing, known as the flat ring type, for outside packed plunger pumps and plunger elevators was designed to effect an absolute seal by means of a resilient flap.

Boiler Water Level Reproduced by Gage Glass at Distant Points

AN instrument named the "Pneumercator Distant Gage Glass" has been perfected by the Pneumercator Company, Inc., Brooklyn, N. Y., to reproduce the gage glass on the boiler at full size and filled with water at distant points in a vessel. The instrument itself can be located either above or below the boiler and at any distance from it, such as the engine room, central control station or the chief engineer's office. This is of importance on oil burning vessels where in many cases each separate fire room is shut off from direct connection with the engine room, the entrance being made from the deck above. This necessitates the engineer on watch to travel from one fire room to another to read his gage glasses. By the use of the distant glass, the gage glasses for all boilers can be located at any convenient spot.

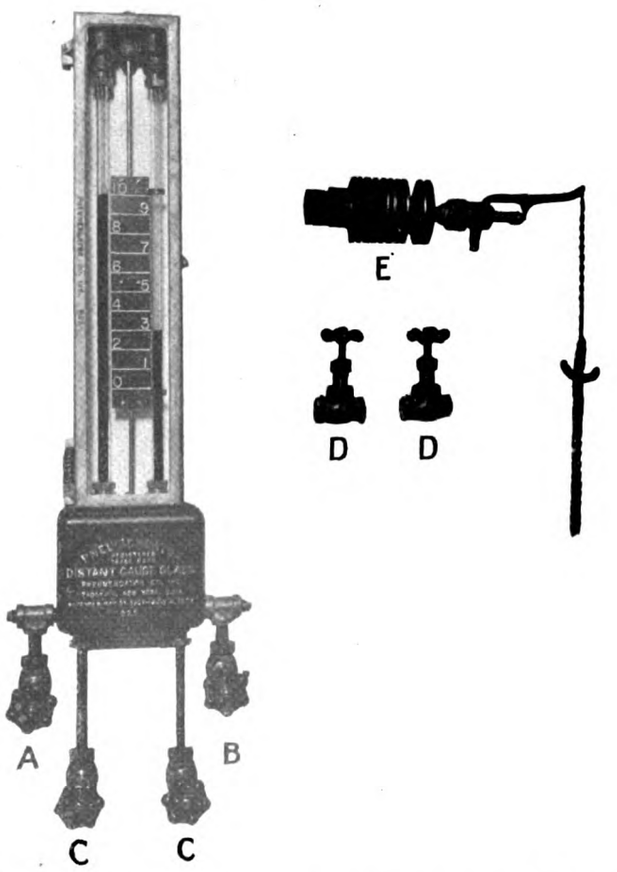
The indicating portion of the instrument itself as shown in the accompanying illustration is in its lowest terms an inverted "U" tube, each leg of which is directly connected to the boiler by 3/8-inch brass pipe; one leg which is known as the steam leg is connected to the steam space of the boiler at the top of the boiler gage glass and the other, or water leg, to the water space of the boiler below the gage glass. Both legs are cross connected by a special fitting which is called a maximum tube and which in reality is a small condenser. The center of the maximum tube is located on the same elevation as the top of the gage glass on the boiler.

When the valves connected to the boiler and the indicating portion of the instrument are open, the water leg line will fill with water directly from the boiler and the steam leg line will fill by condensation to the point where the water in the steam leg flows through the cross connection (maximum tube) back to the water leg and then to the boiler.

When these lines are both filled with water the following condition exists: The steam leg near the boiler is filled to the center of the cross connection (maximum tube) and the water leg to the level of the water in the boiler, or to the same level as the gage glass on the boiler indicates.

Now as both the water lines are subjected to the boiler steam pressure, the water is forced through the pipes to the instrument which is arranged to read the differential between the fixed head of water in the steam leg and the varying head in the water leg. The water level in the steam leg of the instrument itself always represents the bottom of the top gland nut on the boiler gage glass and when the top graduation of the sliding scale between the two columns of the instrument is placed opposite this level the actual water level in the boiler is shown in the right column of the instrument.

The tubes used in the instrument itself are standard for any size boiler and any pressure from 25 to 300 pounds. The sliding scale is laid out to correspond with the gage glass on the boiler. For instance, the illustration shows an instrument designed for a 10-inch gage.



Operating Parts Supplied with "Distant Gage Glass" Equipment. A, Steam Leg Valve; B, Water Leg Valve; C-C, Water Drain Valves; D-D, Valves; E, Maximum Tube

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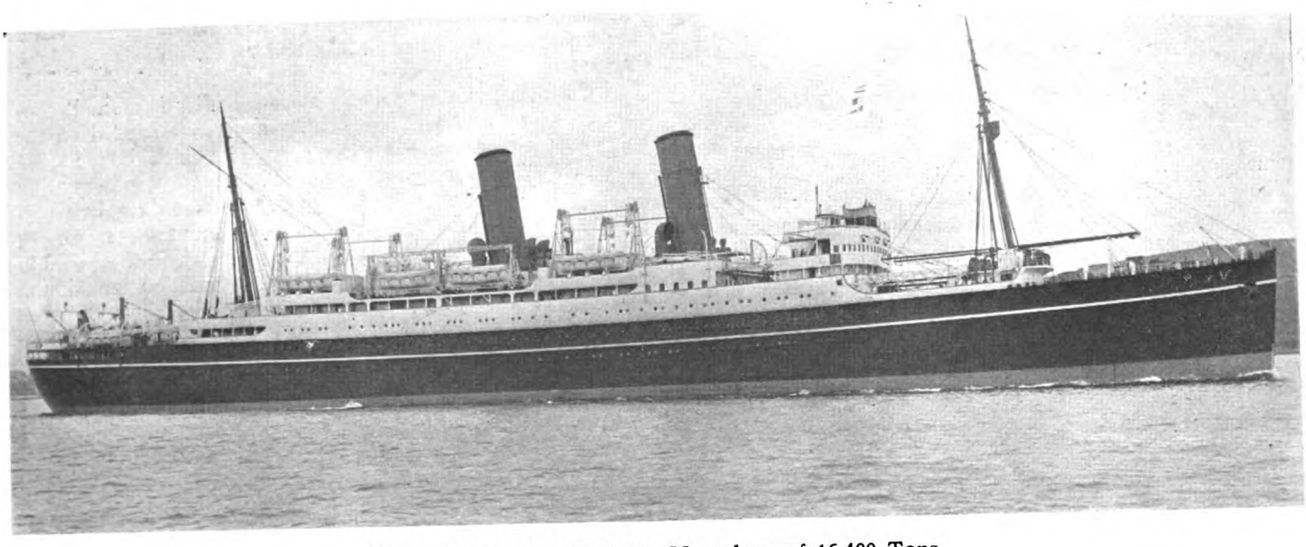

New Canadian Pacific Liner Montclare, of 16,400 Tons

Atlantic Liner Montclare Increases Canadian Service

The Latest Addition to Canadian Pacific Fleet Completes Construction Program for Passenger Vessels

THE passenger vessel *Montclare,* a sister ship to the *Montrose* and *Montcalm,* of the Canadian Pacific Steamships, Ltd., recently completed her maiden voyage from Liverpool to Canada. With her completion, the passenger ship program of the company is finished, the other vessels having been commissioned in the Atlantic service early in the year. The *Montclare* was built by Messrs. John Brown & Company of Clydebank, Scotland. It is interesting to note that the company has added a fleet aggregating 134,607 gross tons to its service in a single year.

General Details of the Montclare

The *Montclare,* like her sister ships, is built to Lloyd's highest classification and meets all the requirements of the Board of Trade as a passenger ship. The principal dimensions of the vessel are:

Length between perpendiculars	549.5	feet
Length on the waterline	563	feet
Breadth, molded	70.2	feet
Depth to shelter deck (C deck)	43.25	feet
Depth to boat deck	68	feet
Gross tonnage	16,400	

The vessel is of the shelter deck type with the bridge deck extending almost the full length with long erections above. Twelve watertight bulkheads, extending to the shelter deck, divide the ship into thirteen watertight compartments. A cellular double bottom, in which is stored oil fuel, reserve feed water, fresh water and water ballast, extends fore and aft the complete length of the ship and is carried well up to the bilges, giving additional protection in case of collision or accident at sea. The machinery spaces are further shielded by longitudinal bulkheads. Fresh water tanks are also built alongside the shaft tunnels.

Accommodations

Provision is made for 554 cabin passengers in staterooms amidships which are arranged for 2 and 4 passengers each. The cabin dining saloon, which extends for the full breadth of the ship, is situated on "D" deck amidships convenient to the main entrance.

At the forward end of "A" deck is the cabin lounge arranged in small bays and corners with a separate writing room and a card room at the forward end. The lounge is decorated in Georgian style, giving a very pleasing effect. Forward of the cabin lounge is the card room on the port side paneled in French walnut while the writing room is located on the starboard side. Both rooms are well lighted by large windows and have electric fires.

Abaft of the after funnel hatch on the same deck the cabin drawing room is situated with a raised deck over and a large bay window on one side. Next to this is located a children's room.

The cabin smoking room is arranged at the aft end of "A" deck. The decorative work and furnishings have been carried out with care. This apartment is fitted with a large electric fireplace which adds to its comfortable appearance. Extensive promenading space for cabin passengers is provided on "A" and "B" decks.

Third Class Accommodations

Comfortable third class accommodations are provided on "D" and "E" decks in two, four and six-berth rooms. There is also available portable accommodation for an additional number of passengers. The total number of third class passengers carried is 1,252.

The third class dining saloon is situated on "A" deck aft. Two smoking rooms and two lounges are arranged for the comfort of the passengers, one of each is situated on "B" deck aft with smaller ones on "C" deck forward.

The captain's quarters are located on the navigating bridge, the officers on "A" deck forward and the engineers on "C" deck aft complete with cabins, bath rooms, lavatories and the like. The seamen and the boiler attendants and stewards are berthed amidships on "C," "D" and "E" decks.

The galleys, pantries and bakery for first and third class dining saloons are situated amidships on "D" deck. All the latest improvements for cooking and heating have been supplied.

The heating and cooling on the ship is by means of the thermotank system which insures a temperature of at least

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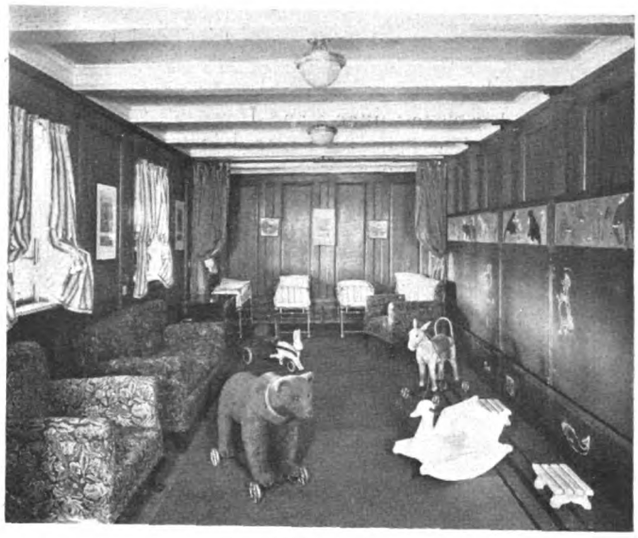
Drawing Room



Nursery

65 degrees F. in the coldest conditions. Ten thermotanks are fitted sufficient to change the air in any one of the compartments to which they are connected at least eight times per hour.

CARGO HANDLING EQUIPMENT

Cargo is handled by means of steel tubular derricks fitted on the masts and derrick posts worked by means of fourteen electric winches. Each hatch is supplied with three derricks.

The watertight doors are operated by Brunton Bros. hydraulic gear and can be opened or shut either individually or collectively from the navigating bridge.

One of the special features of the *Montclare* and the *Montrose* is that the cabins have been fitted with Henderson-Robinson patent unjammable door and lock. The edges of this type door have been cut at an angle which renders it unjammable in case of a collision or other accident that would ordinarily distort the frame, jam the door and imprison the passengers. The locks on the doors are also unjammable.

First Class Dining Saloon

Ample lifeboat accommodations, according to the standards of the International Convention, are provided for all passengers and crew. Two rows of nested boats are fitted on sliding chocks so that they can be moved from one side of the ship to the other and are placed in Babcock and Wilcox (Wylie) patent double acting davits. The remaining lifeboats are worked by "Australis" patent davits. The vessel is also fitted with wireless telegraphy, submarine signalling and gyro compass. A complete fire extinguishing service has been arranged. Pneumercator tank gages are fitted in all oil fuel and fresh water tanks with indicators in the machinery space, so that the tanks are always under the supervision of the engineers.

PROPELLING MACHINERY OF THE MONTCLARE

The propelling machinery is fitted in one engine room and consists of two sets of steam turbines of the Brown-Curtis marine type arranged to work with superheated steam in driving twin screws through double reduction helical gearing. Each set of turbines consists of one high pressure and one intermediate pressure turbine in tandem driving through one set of gearing and one low pressure turbine driving through the second section of the gears. Astern turbines are incorporated in the casings of the intermediate and the low pressure ahead turbines. Adjustable thrust blocks of the Michell type are fitted to the turbines and the bearings of the turbines and gearings are arranged to work under forced lubrication. One condenser of the underhung type is fitted to each set of turbines and bolted direct to the exhaust branch of the low pressure turbine.

The main shafting is of ingot steel and each line has a Michell main thrust block fitted next to the gearing. Propellers are of the built-up type with four manganese bronze blades; the bosses are of cast steel and cast iron cones are fitted over the propeller nuts.

The auxiliary machinery includes two centrifugal circulating pumps; two Weir "Dual" air pumps; two pairs of Weir feed pumps; two hot well pumps; one Weir surface and one direct contact feed water heater; two feed water filters of the gravitation type and necessary equipment for forced lubrication as well as sanitary fresh water and other service pumps. Complete evaporating and distilling plants, auxiliary condenser and pumps are provided.

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Steam is generated by ten single ended cylindrical boilers arranged for burning oil fuel under the Todd mechanical system and for a working pressure of 215 pounds per square inch. These boilers are fitted with smoke tube superheaters. Each boiler has three furnaces and Howden's type of forced draft is used. The boilers are placed in two compartments and each boiler is equipped with a working and standby oil fuel installation complete with the necessary pumps, heaters and strainers. The forced draft fans are electrically driven there being two fans and motors to each of the boiler rooms.

The refrigerator spaces in the vessel, comprising a fish and ice room, meat and poultry room, fruit and vegetable room and milk and butter room, as well as Nos. 5, 6, 7 and 8 cargo holds, are insulated on the "J.D." patent unit system of insulation, consisting of a Deltah compressed cork slab and finished with a white composite insulating slab. The refrigerating machinery and ice machines are of the latest type.

Last of Five New P. & O. Steamers Completed

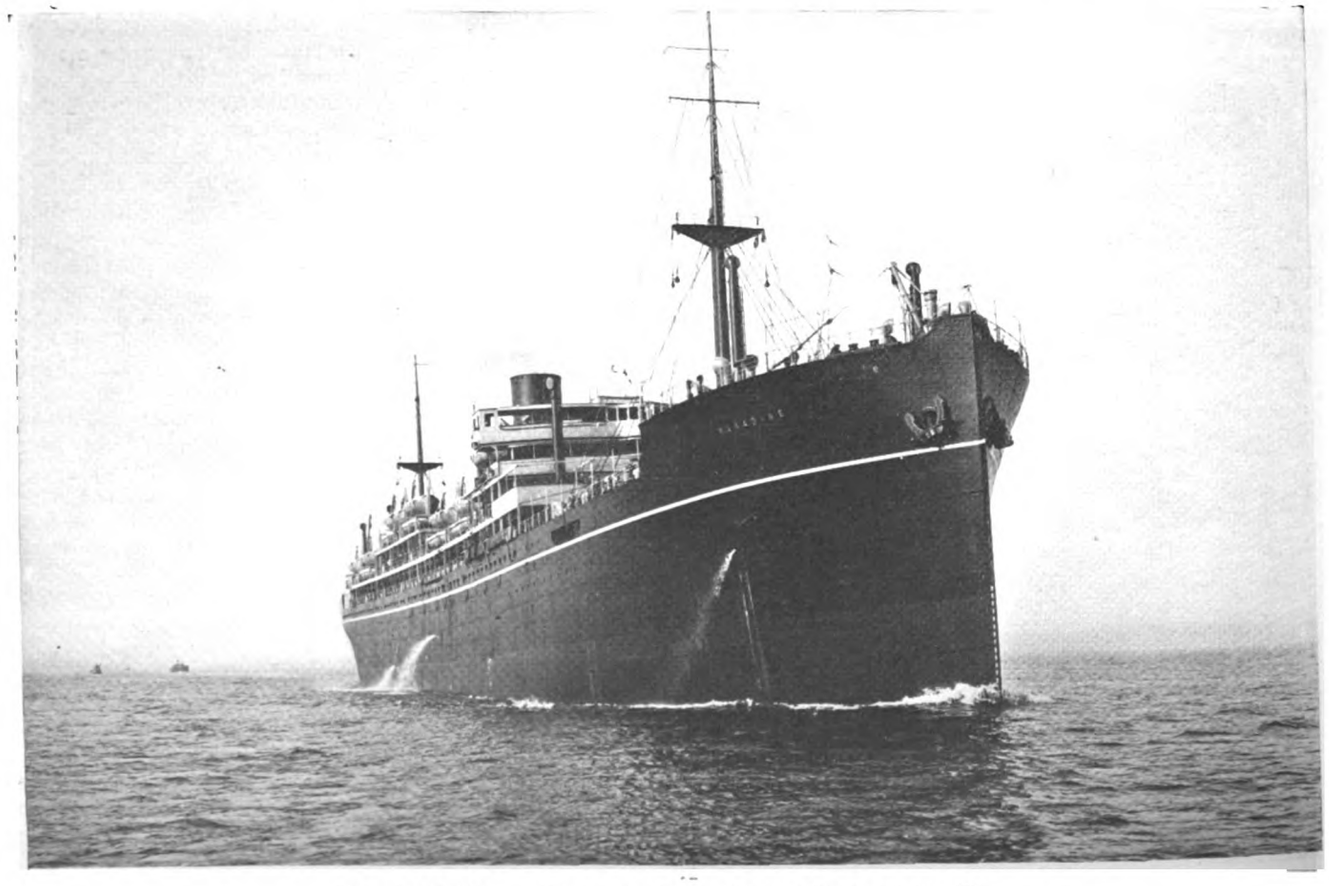
Twin Screw Passenger Vessels of 15,100 Tons Built by Harland and Wolff for Emigrant Trade to Australia

WITH the completion of the S. S. *Bendigo,* a twin-screw passenger vessel of 15,100 tons, Harland and Wolff, Ltd., Greenock, has delivered to the Peninsular and Oriental Steam Navigation Company for its branch line service from London to Australia, via the Cape, five sister ships especially designed for the emigrant trade. The new vessel, which is classed 100 A.1 at Lloyd's, is 520 feet by 64 feet by 41 feet. Accommodation on a very complete scale has been provided for about 500 cabin passengers and accommodation is available for nearly 1,000 third class passengers on the main deck. Nine bulkheads divide the vessel into ten watertight compartments, and the double bottom is sub-divided for water ballast or fresh water, the fore and aft peaks being reserved for water ballast.

The main entrances are of a spacious and airy character. The dining saloon is a large apartment and is arranged to allow full complement of cabin passengers to dine at the same time. The framing is of a simple but pleasing character, having a teak and pitch pine dado with panelling above painted white. Every care has been taken to secure good ventilation and steam heating has been arranged all around the sides and ends of the saloon.

The music room walls are tastefully panelled and finished white with hardwood dado. This apartment is situated on the shade deck. The smoking room, which is on the boat deck aft, is panelled and painted in white with hardwood dado.

The staterooms are situated in the deckhouse on the shade



P. and O. Steamer Baradine, Sister Ship of the S. S. Bendigo

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deck and also on the upper deck, and are arranged on the well known tandem principle, which ensures natural light and ventilation.

ELECTRICAL EQUIPMENT

The electrical installation consists of four main generators and one vertical oil engine driving a dynamo situated well above the waterline. All the watertight doors, which are electrically operated, can be closed simultaneously from the bridge. The ship's whistle is automatically operated electrically from the bridge.

The electrically driven gear includes large forced draft fans for the boilers, also refrigerating fans and large ventilation fans. There are two hoists for the pantry, and the dough mixer, dish washer and potato peeler are also electrically driven. Loud speaking telephones have been installed to assist in navigation, and there are considerably over 1,000 lights and above 70 motors in the vessel.

PROPELLING MACHINERY

The *Bendigo* is propelled by twin screws, driven by two sets of quadruple expansion engines, balanced on the Yarrow, Schlick and Tweedy system, thereby eliminating vibration as far as possible. The condensers are of the largest design, independent air and circulating pumps being provided. Steam is generated in 5 large coal burning cylindrical boilers working under forced draft. The engine room auxiliaries are all independent of the main engines and are of the latest and most up-to-date type.

High Speed Wire Brush for Cleaning Metal Surfaces

THE increasing use of air-driven wire brushes for cleaning metal surfaces has demonstrated the need of high rotative speed. Especially has this been true on such cleaning work as the removing of paint, rust, dirt and scale from tanks, steel ships, structural steel forms, etc., where the area to be cleaned is large and a fast rate of work is required. It has been found that a wire brush turning at high speed cleans faster and also stands up to the severe service much better than if only revolving at 2,000 or 3,000 revolutions per minute.

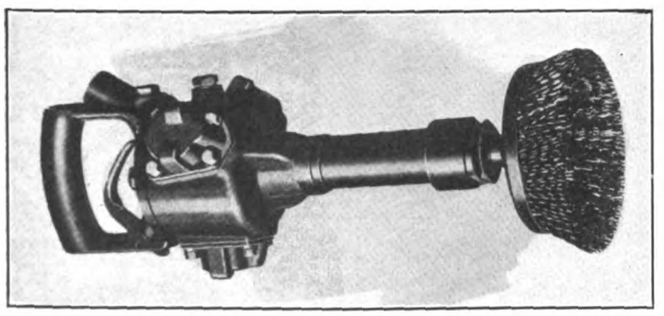


Fig. 1.—No. 601 Little David Wire Brush

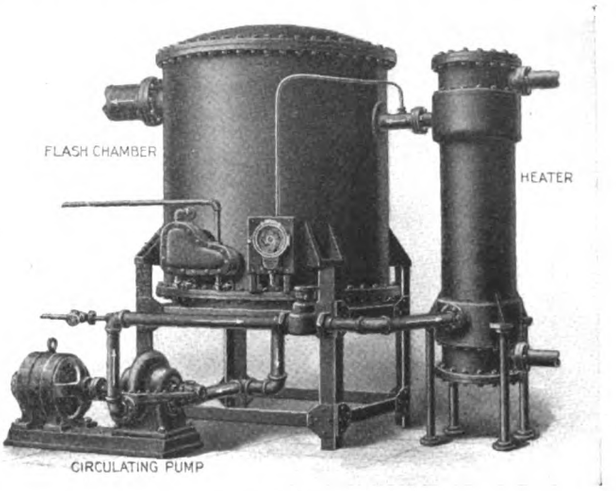
The Ingersoll-Rand Company, New York, has recently brought out a high speed cleaner (Fig. 1) known as the No. 601 Little David wire brush, which has a maximum speed of 4,200 revolutions per minute. This machine is said to be unusually successful in operation, effectively cleaning surfaces such as mentioned above and also iron and steel castings. It is designed to do a first-class cleaning job and effect a considerable saving of time and labor as well.

The air motor is of the three-cylinder type such as used in the Little David portable grinder which has been thoroughly tested out in the severe service to which pneumatic grinders are subjected. The machine is designed to be simple in construction, well balanced and operate without vibration. Light weight has been attained by using an aluminum casing reinforced with cast-in steel bushings. The weight of the complete machine is 14 pounds; the average free speed at 90 pound air pressure, 4,200 revolutions per minute; the length overall, 17½ inches and the diameter of the wire brush, 6 inches.

Non-Scaling Flash Evaporator for Producing Pure Feed Water

A FLASH evaporator having non-scaling features has been developed by the Schutte and Koerting Company, Philadelphia, Pa., for the production of pure boiler feed water. The equipment consists essentially of a tubular heater, an evaporator proper or flash chamber maintained under vacuum and a circulating pump. A distilling condenser is also used, if the vapor does not pass directly from the flash chamber to the main condenser—otherwise no distiller is required.

The raw water is heated in the tubular heater to a temperature that is both below the boiling point at atmospheric pressure and also below the temperature at which the impurities in the water are deposited as scale. This temperature is, however, higher than the temperature corresponding to the vacuum maintained in the evaporator. The circulating pump maintains the water in the heater under pressure and, as this heated water enters the evaporator, it flashes into vapor due to the vacuum existing therein.



Complete Flash Evaporator Unit

The flash evaporator is adapted for small, as well as large installations. Practically pure water is produced. It is claimed that even when salt water is used as evaporator feed the salt content of the distillate is less than 6 parts of salt in 100,000 parts of water.

The formation of scale in the heater and the precipitation and accumulation of other solid impurities are eliminated, the scale-forming impurities and other salts remaining in solution during the entire evaporation process, because of the low temperature at which evaporation takes place. This is also due to the fact that no evaporation can occur on the heating surface of the water heater. The system can be operated continuously.

The internal structure of the flash chamber is so arranged as to divide the incoming water into a multitude of thin films. This splitting of the water into slices or films is one of the outstanding characteristics of the flash evaporator and is one of the features wherein this type of evaporator differs from apparatus in which the raw water is ordinarily boiled in a large mass.

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Diesel Engine Revolutions and Propeller Efficiency

Propeller Calculations for Single and Twin Screw Installations with Variable Revolutions and Fixed Speed of Ship and Also with Fixed Revolutions and Variable Speed of Ship

By A. J. C. Robertson*

ENGINEERS and shipbuilders are generally aware that low propeller revolutions are necessary to securing high propeller efficiencies, but how low these revolutions should be and what gain in efficiency can be obtained by dropping the revolutions are facts which it is very difficult to determine.

When the revolutions of the propeller are approximately the same as those of which experience has already been obtained in steamships, it is comparatively easy to forecast what the propulsive efficiency of the ship will be but, owing to the enormous weight of a slow speed Diesel engine, it has been the general practice of Diesel engineers to design their engines for higher revolutions per minute than is the case with reciprocating steam engines at present used in steamships.

It, therefore, becomes necessary, if any investigation is made of propeller efficiencies, to rely upon the data secured by model test experiments and published by Taylor, Froude, Durand, Luke, Rota and others.

*Naval architect, Munson Steamship Line, New York.

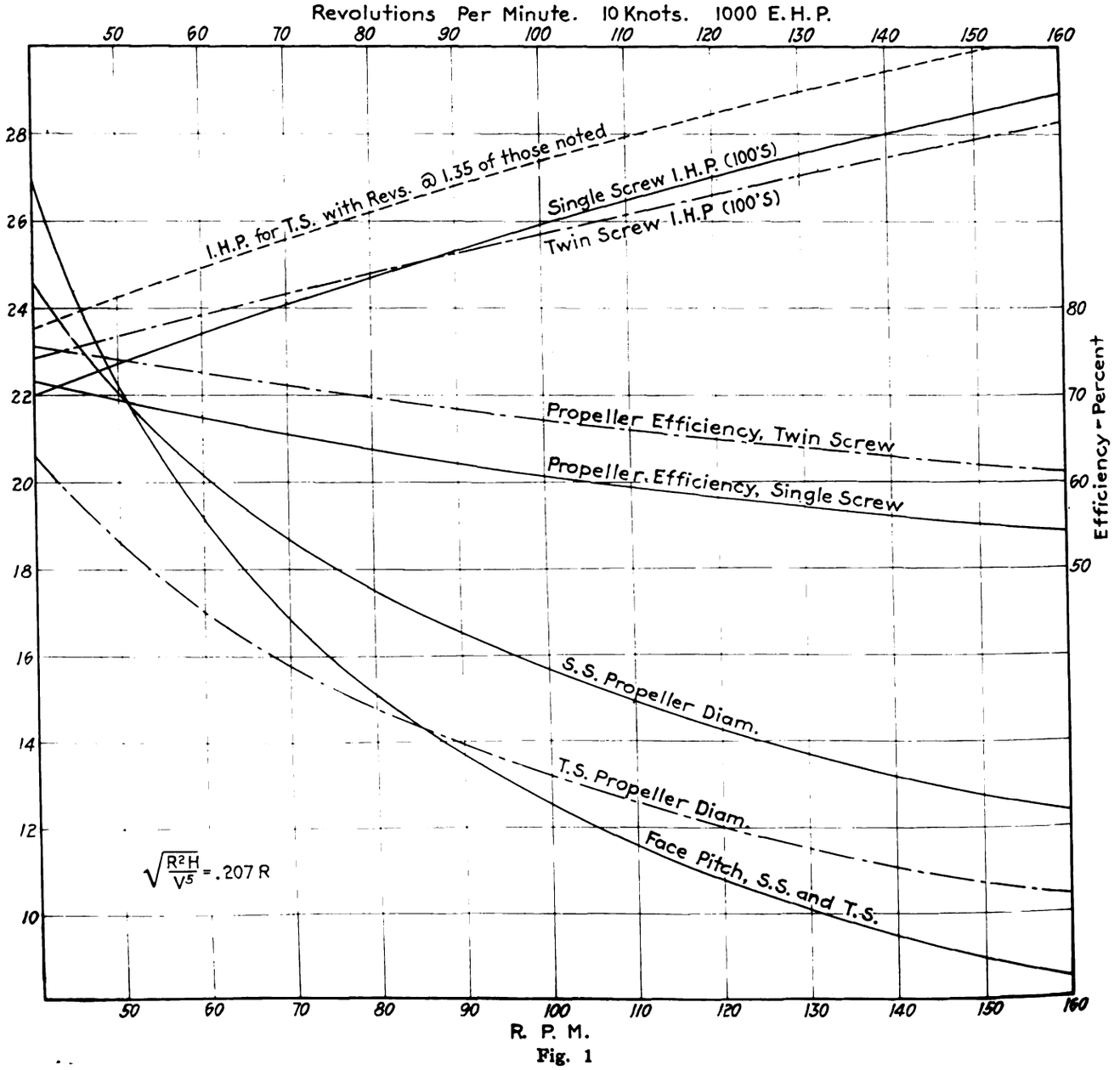
Revolutions Per Minute. 10 Knots. 1000 E.H.P.
50 60 70 80 90 100 110 120 130 140 150 160
28 26 24 22 20 18 16 14 12 10
I.H.P. for T.S. with Revs. @ 1.35 of those noted
Single Screw I.H.P. (100's)
Twin Screw I.H.P (100's)
Propeller Efficiency, Twin Screw
Propeller Efficiency, Single Screw
S.S. Propeller Diam.
T.S. Propeller Diam.
Face Pitch, S.S. and T.S.
$\sqrt{\frac{R^2H}{V^5}} = .207\,R$
80 70 60 50
Efficiency - Percent
R. P. M.

Fig. 1

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Unfortunately the above data have been presented to the public in a large number of different forms, which render it inaccessible to those who have not the time to make an exhaustive study of the matter. Admiral Taylor has, however, presented a large number of his experiments in a form which is comparatively easy to apply to ship calculations, but even here the diagrams seldom extend to as high revolutions as are necessary to form a proper opinion on the subject.

R. E. Froude's classical paper on propellers presented to the British Institution of Naval Architects in 1908 is not so well known on this side of the Atlantic, but in some ways is even more useful for analysis purposes and can be plotted in the same way as Admiral Taylor's data. In the following notes the writer has made large use of Froude's as well as Taylor's model tests.

To illustrate the influence of revolutions upon propeller efficiency, the writer has assumed that it is desired to drive a ship of ten to twelve thousand tons deadweight at ten knots, and to do this it is assumed that one thousand effective horsepower is indicated by the model tests.

Estimate of Wake

When calculating the diameter and pitch of a propeller to absorb 1,000 horsepower at ten knots, the first thing necessary is to know what wake to anticipate in order to arrive at the speed at which the propeller advances in still water. This wake depends to a certain extent upon the diameter and location of the propeller, and to a very material extent on the fullness of the after lines of the vessel, such fullness being measured by the block coefficient, or more accurately by the prismatic coefficient of the after body.

I have been guided by Luke's experiments in assuming a wake fraction of 0.253 for this vessel with single screw and 0.190 for twin screw, these figures being the fraction of the speed of the ship. This gives us a speed of advance for the propeller of 7.47 knots for the single screw vessel and 8.10 knots for the twin screw vessel.

In addition we must remember that 1,000 shaft horsepower is the power required in a ship without propeller bossing, and for the twin screw vessel an allowance of 10 percent has been added to cover the resistance of the propeller bossings. It may be noted that this figure varies somewhat with the form of bossing on the ship, and to a certain extent with the amount of bossing, which is a function of the prismatic coefficient of the after lines, but 10 percent is a fair allowance to cover average practice for propeller bossings or struts.

A ship hull efficiency of unity has also been assumed.

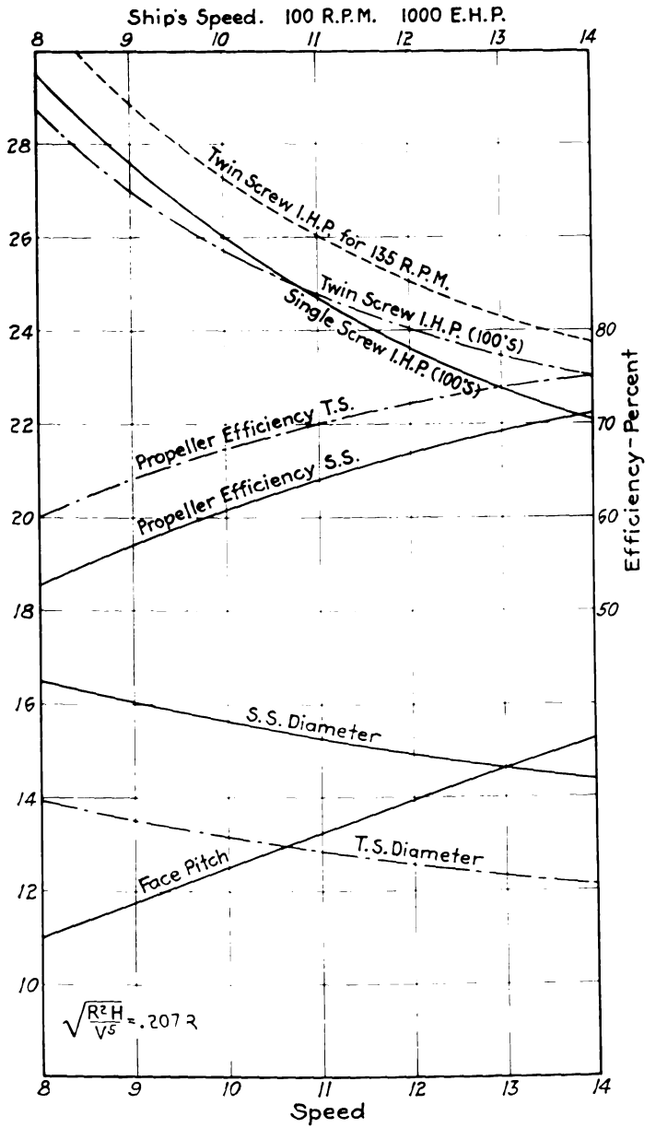

Fig. 2

Propeller Calculations for Variable Revolutions and Fixed Speed of Ship

For the above conditions propellers have been calculated with revolutions per minute of from 40 to 160, both for single and twin screw vessels, and the propeller diameters and pitches have been plotted on the diagram shown in Fig. 1.

This calculation assumes that three- or four-blade propellers of a mean breadth ratio of about 0.30, or a disk area ratio of 0.45, would be used; the blade thrust coefficient is taken as 92½ percent of Froude's coefficient for model propellers, in line with the full size thrust experiments of Holt. From these assumptions a calculation has been made of the slip ratio showing highest efficiency for the chosen revolutions and the pitch ratio and efficiencies thereby obtained. The diagrams therefore give propeller diameter, pitch and efficiency where the efficiency is highest, and it is interesting to note that the curves of pitch for the single screw and twin screw propellers are identical, though the condition of working as to load per square inch of propeller area is naturally very different.

On this diagram I have also plotted the propeller efficiencies as taken from Taylor's experiments and the corresponding indicated horsepower of the Diesel engines, assuming a rotative efficiency of 85 percent and a mechanical efficiency of 75 percent. This figure is possibly a little bit high, though higher figures are claimed for certain engines under certain conditions.

Power of Single and Twin Screws Equal at 88 Revolutions per Minute

From this diagram it will be noticed that at 88 revolutions the engine power is equal for single and twin screws, and that thereafter the twin screw engine shows a higher efficiency than the single screw installation. At 102 revolutions the power required on a single screw would be 2,600 indicated horsepower but, if put into twin screws, the revolutions would probably be, say, 130 and at that figure these engines would require to be of 1,350 horsepower each. Other comparisons are easily made from the diagram.

It will also be noted that as between 80 and 120 revolutions per minute, the excess power is 237 indicated horsepower, which would represent an additional fuel consumption per annum of approximately 150 tons. From such data it is possible to figure out whether the additional weight of the 80 revolution engine is worth accepting, or whether the addi-

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tional deadweight capacity with the higher speed engine would not more than pay for the higher fuel consumption.

It is very interesting to note that the difference in diameter of the single screw and twin screw propeller is only 15 percent.

As against the higher efficiency of the single screw for this vessel it should be noted that the ratio of the disk area of the propeller to the mid-section area of the ship for the twin screw ship is better by 40 percent than the single screw ship, at equal revolutions, and this will affect the maintaining of speed at sea and the maneuvering ability of the ship. The pressure per square inch on the propeller surface, also, in a single screw ship will be higher to the extent of about 25 percent but, as this figure does not exceed five pounds per square inch for 140 revolutions, it is not a serious matter except when the vessel is pitching heavily.

Speeds at Which Single and Twin Screws Are Equally Efficient at Various Revolutions

It has been noted that the curves of the indicated horsepower for the single screw and twin screw vessel intersect at 88 revolutions per minute. A calculation has, therefore, been made to discover at what speed of the twin screw vessel the efficiency will be equal to that of the single screw vessel at 10 knots and various revolutions.

The figures are as follows:

Revolutions	60	80	100	120	140	160
Speed in knots	10.71	10.14	9.91	9.79	9.64	9.43

the twin screw being more efficient above these figures.

Case of Fixed Revolutions and Variable Ship's Speed

In addition to examining this problem for a fixed speed of ship and a series of different revolutions, I have also examined it from the other point of view of fixed revolutions and variable ship's speed, and a diagram giving these results is presented in Fig. 2.

The revolutions per minute assumed were 100 and the wake fraction for single and twin screw ships was assumed as before so that the results are an interesting demonstration of how the speed of the ship at given revolutions affects efficiency. It will be noted from this diagram that on fixed revolutions the single screw vessel shows up better at the higher speeds.

The revolutions of the twin screw engines at various speeds to give efficiencies equal to the single screw engine at 100 revolutions per minute are as follows:

Speed in knots	8	9	10	11	12	13
Revolutions per minute	115.3	111.2	105.6	94.3	89.5	77.0

Both of these comparisons assume that the engine revolutions at 1,000 horsepower and 550 horsepower would be alike, but this is not the case; in general service it is found that the revolutions vary inversely with the square root of the horsepower which would make the revolutions for the smaller engine 135 compared with 100 for the larger. On this basis the indicated horsepower for the twin screw engines has been calculated for both diagrams, and is shown in dotted lines; it will be noticed that the power of the twin screw machinery is approximately 5 percent higher than the single screw through the range of our calculations. I believe this fairly represents the difference in propeller efficiency between the two methods of propulsion, but, as already pointed out, a choice of revolutions per minute cannot be made solely on the question of lowest indicated horsepower because, in reducing revolutions, weight, first cost, cost per deadweight ton, and interest charges go up, and deadweight carrying capacity drops as well as fuel consumption, and it is a question of ship economy as to what revolutions should be accepted.

The utility of these diagrams can be very much increased when it is remembered that the pitch ratio and propeller efficiency is constant for the same revolutions squared, multiplied by horsepower and divided by speed of advance to the fifth power $\left[\frac{R^2 \times H}{V^5}\right]$, and propeller diameters vary with the speed of advance divided by the revolutions.

Examples

One or two examples of the use of this diagram may be given:

(1) Assuming a speed of 10 knots and 1,000 effective horsepower, at what revolutions would a single screw electrically driven engine require to run in order to give efficiencies equal to a pair of twin screw Diesel engines running at 130 revolutions per minute, the efficiency of the electric drive being taken as 90 percent? From diagram I the twin screw outfit consumes 2,700 indicated horsepower, therefore the equivalent power for the single screw Diesel drive will be 2,700 multiplied by 0.90, equal to 2,430 indicated horsepower, and from the diagram the electric motors will have to run at a speed of 74 revolutions per minute, the respective propeller diameters being 11 feet 6 inches and 18 feet 2 inches.

(2) Apply diagram (1) to a ship of 8½ knots and requiring 420 effective horsepower (bare model) and ascertain whether a single screw at 140 revolutions per minute or twin screws at 175 revolutions per minute would be more economical in power.

As $\sqrt{\frac{R^2 H}{V^5}}$ is constant for equal efficiencies the revolutions on the diagram should be increased in the ratio $\sqrt{\frac{420}{1000}} \times \left(\frac{10 \times .747}{8.5 \times .747}\right)^{2.5}$ i.e. by 1.0277.

Then read revolutions $140 \times 1.0277 = 144 = 2{,}820$ indicated horsepower and $175 \times 1.0277 = 180$ revolutions per minute and by exterpolation we read 2,915 indicated horsepower for twin screws, or correcting these figures for this proposal $\frac{420}{1000} \times \begin{cases} 2820 = 1184 \\ 2915 = \underline{1224} \\ \quad\quad +40 \end{cases}$ and the twin screw ship would require 40 more indicated horsepower than the single screw ship equal to, say, 30 tons of oil fuel per annum.

At 140 revolutions per minute of engines = 14.4 on diagram, diameter = 13.0 feet.

Pitch = 9.25 feet and, as these vary as $\frac{V}{R}$, the new diameter and pitch would be—

$$\text{Diameter} = 13 \times \left\{\frac{8.5}{10.0} \times \frac{144}{140} = .8742\right\} = 11.36 \text{ feet.}$$

$$\text{Pitch} = 9.25 \times .8742 = 8.08 \text{ feet.}$$

Todd Oil Burning Equipment to be Installed on Passenger and Freight Vessels

CONTRACTS for the installation of mechanical fuel oil burners in twelve passenger and freight vessels have recently been awarded to the Todd Shipyards Corporation. These vessels, totaling 78,100 indicated horsepower, include the *Empress of Scotland* of the Canadian-Pacific Steamships, Ltd.; the *Calamares, Pastores, Limon, Esparta* and *San Jose* of the United Fruit Company, the *El Cid, El Siglo, El Dia* and *El Rio* of the Southern Pacific Company and the *City of Jacksonville* of the Mallory Line.

The work on the five fruit steamers and the Red Star liner *Kroonland,* which is being fitted with Todd mechanical

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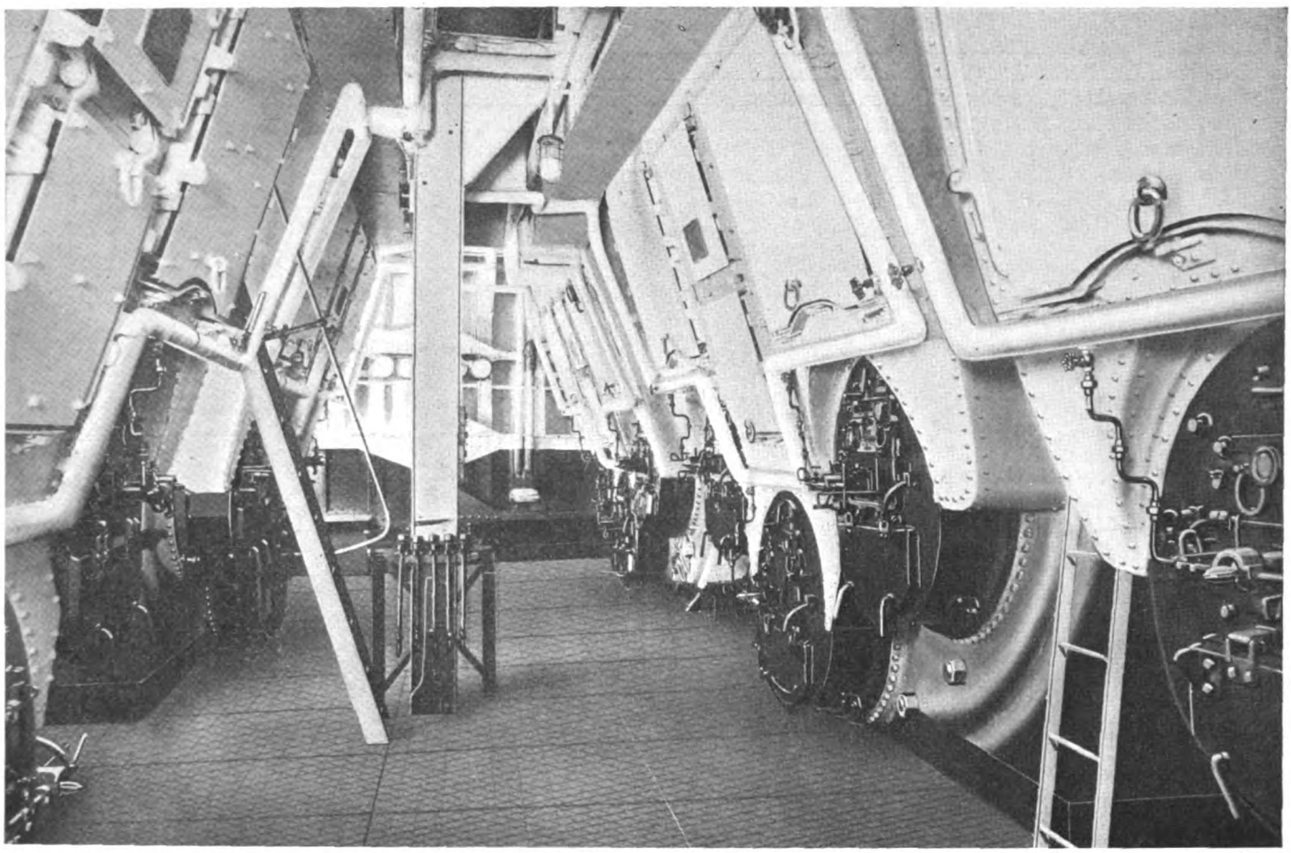
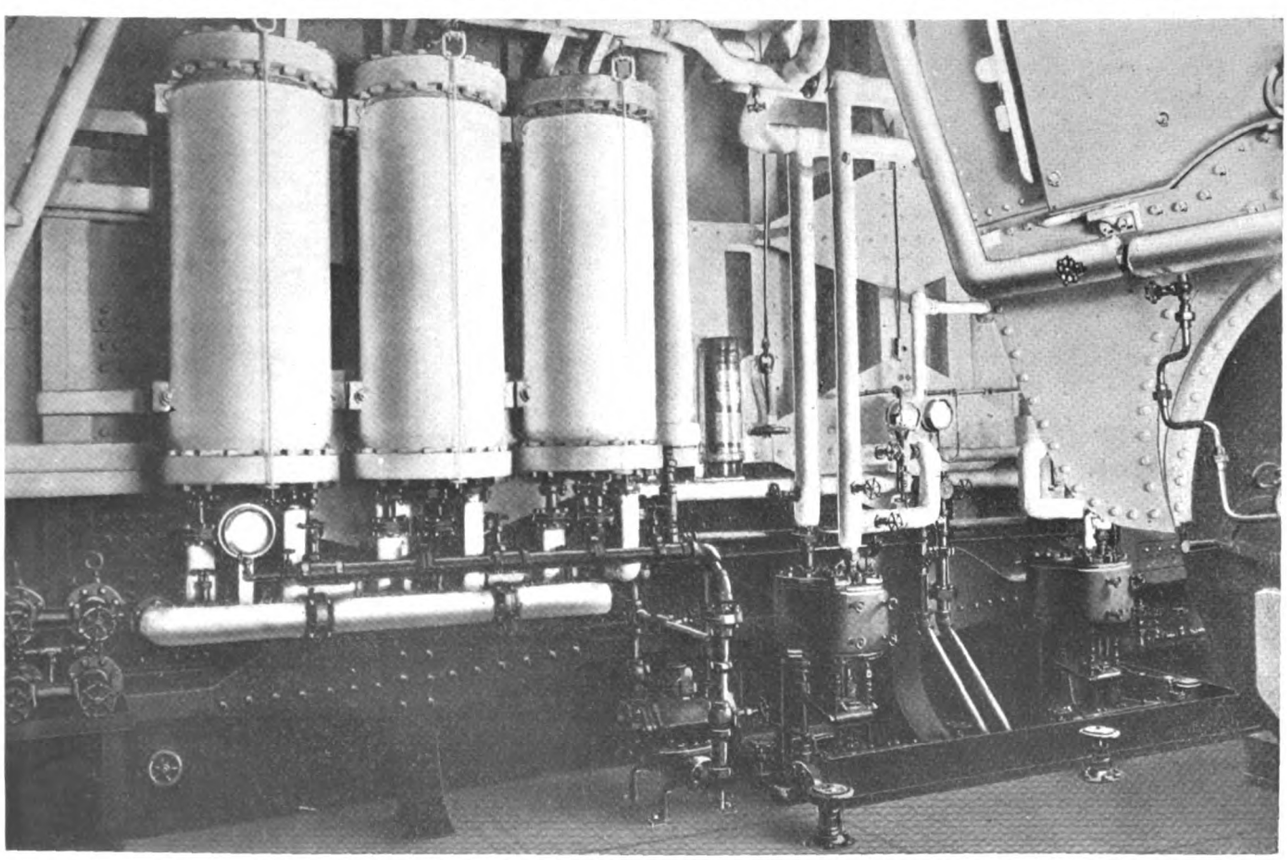


Boiler Room of Mallory Line Steamship San Jacinto, Showing Installation of Todd Mechanical Oil Burners



Section of Boiler Room of the San Jacinto, Showing Heating and Other Auxiliary Apparatus Installed in Connection with Todd Mechanical Oil Burning System

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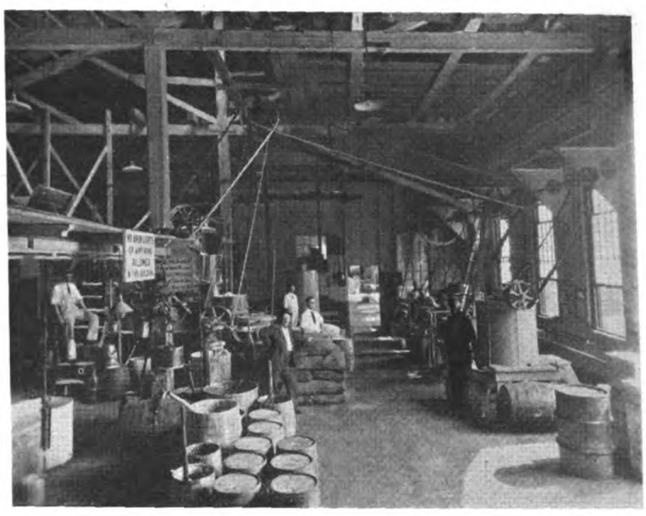
oil burners in place of an older type system that was installed some time ago, is being carried out at the plant of the Robins Dry Dock and Repair Company in Brooklyn. The remaining vessels of the United Fruit Company and the *City of Jacksonville* are being converted at the plant of the Tietjen and Lang Dry Dock Company in Hoboken.

The accompanying illustrations show the firing aisle and fuel feed tanks of the *San Jacinto* which was recently completed. An excellent idea of the appearance of the oil burning equipment in a finished installation may be gained from the work on the *San Jacinto*.

The *Empress of Scotland* will be fitted with Todd burners on her next arrival at an English port by Todd Oil Burners, Ltd. of London. She was formerly the Hamburg-American liner *Kaiserin Auguste Victoria* of 24,581 gross tons. There are fifty-one furnaces in this vessel and the decision of her owners to replace her oil burners with Todd mechanical equipment followed the successful performance of the Canadian Pacific Steamships, Ltd., new liner *Montclare*. This vessel was equipped with this type burner before she left the yards of her builders, the John Brown Company at Clydebank, Scotland.



Mixing Department of Paint Plant

Newport News Yard Has Plant for Producing Navy Standard Paint

FOR a number of years the Newport News Shipbuilding and Dry Dock Company has been manufacturing Navy standard bottom paint according to Navy specifications for use on all Government vessels built at the plant. The plant in which the manufacture of paint is carried on consists of the manufacturing shop in which are installed stone and iron mills and agitators. This shop has a capacity of 800 to 1,000 gallons of paint per day. Adjacent to the paint shop is an oil storage building where the various mixing oils are stored. A third section contains the marking and storage departments in which the finished products are handled. Here also is located the shipping department from which paint sold to outside firms is distributed. This section completes the paint plant.

During the past year the Newport News Shipbuilding and Dry Dock Company was awarded the United States Shipping Board paint contract for all ports from Newport News, Va., to Galveston, Texas. The specifications for this paint were identical to the Navy standard formula. In addition to the other products of this plant, the company has put a marine bottom paint on the market for which the producers claim high quality, durability and reliability at a moderate price to shipowners and operators. This paint, known as Newport News Shipbuilding and Dry Dock Company's composition, is marketed at all ports along the South Atlantic and Gulf coasts.

A great deal of the paint being used in connection with the reconditioning of the *Leviathan* has been manufactured at the paint plant of the shipyard.

In addition to the production of marine bottom paints, the Newport News paint plant also manufactures a variety of other marine paints, including topside paints, copper paints and hold paints.

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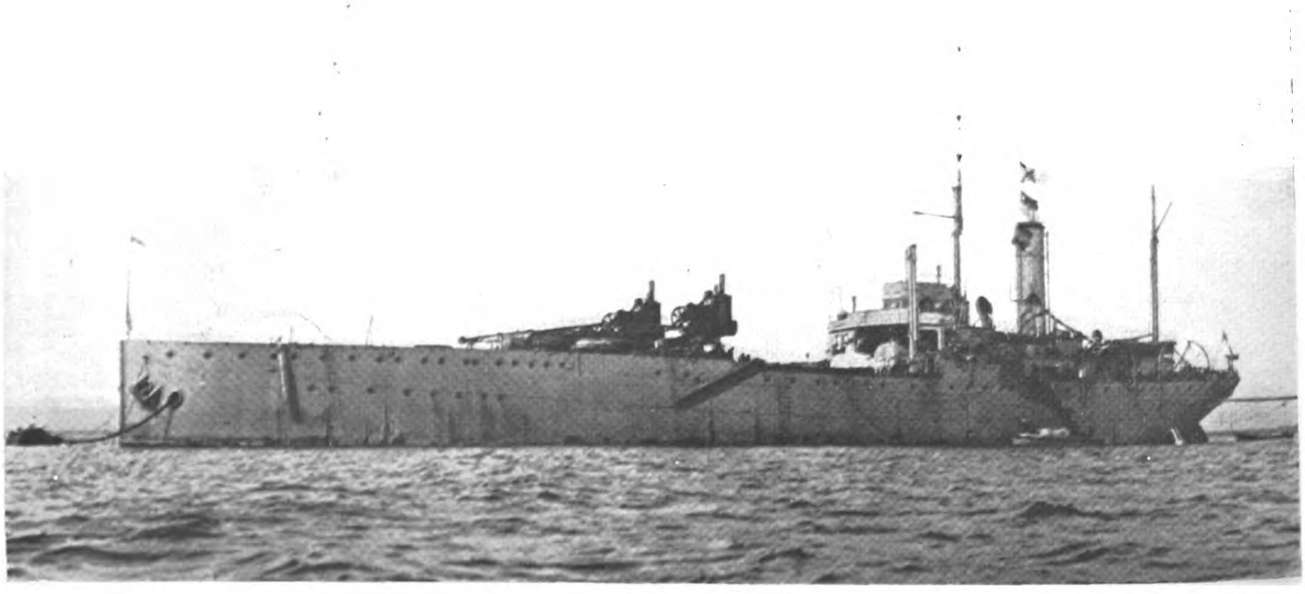

(Photograph from Kadel and Herbert, N. Y.)

The British Navy's Latest Aeroplane Carrier

H. M. S. **Ark** Royal, the British Navy's latest seaplane carrier, photographed at Weymouth. On the forecastle can be seen two cranes (lowered), which are used to hoist the machines when they alight at sea.

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Recent Developments in Marine Insurance

Modified Hague Rules Endorsed—Possible War Blockade Causing Insurers Anxiety—Protection Clause Against Bootlegging Operations

By "Bordereaux"

IT is, perhaps, well to understand the exact attitude of American marine underwriters with respect to carriage of goods by sea, as represented in the recommendations by them to the American conferees at the recent international meetings at London and Brussels. In this country the Hague Rules became much more acceptable to insurance men when disguised by the amendments made by the Imperial Shipping Committee, and the American Institute of Marine Underwriters unanimously voted the amended proposals as "a substantial improvement upon the rules as formerly drawn, and that those rules, as so amended, represent a desirable improvement upon existing law." But the Institute felt that our conferees should urge a few additional changes, the substance of which was as follows:

1. That the rules be extended to include "on deck" cargoes.
2. That the rules should be made to apply to cargo so long as it is in the custody of the carrier and not merely while waterborne.
3. That the notice clause should be amended so any notation of loss or damage on receipt given to carriers should be deemed sufficient notice of claim.
4. That the carriers should be exempted from losses occasioned by fire only when such fire is not caused by design or neglect of the carrier.

With respect to the third proposed amendment it should be borne in mind that our courts have held that notation of damage on receipt given by consignees to carriers does not constitute an actual notice of claim, and there seemed to be no serious objection to the amendment as suggested by the Institute.

There is no doubt that if these rules are to be useful they should be made mandatory. The Institute's thought is that ultimately treaties will be entered into by the various maritime countries, and such treaties will have the effect of making these rules mandatory in the case of all bills of lading issued in such countries.

War Risk Conditions

WAR risk coverage is again to the fore, owing to the serious disturbance in the Near East and a reasonable apprehension that it may develop into something more widespread and grave. Underwriters are quoting war rates to Greek ports at ½ percent, and to Constantinople at 2 percent, subject to forty-eight hours' acceptance. Greek and Turkish vessels are excluded from these rates. War risk, in the New York market, is placed under a form of cover which limits the protection to "waterborne only," and underwriters are reluctant to extend this form to cover property while on shore. The risk of strikes, riots and civil commotions is, of course, covered on shore, but this protection does not include damage or destruction from the acts of organized warfare.

The possibility of a blockade is causing insurers anxiety because this would oblige vessels to discharge at other than the port of destination; and this involves expense of a nature that underwriters do not feel liable for under the war risk clauses, but nevertheless one that they frequently defrayed during the recent war.

The language of the war clause employed by the great majority of American underwriters reads as follows: "Excluding claims for delay, deterioration and/or loss of market, and warranted not to abandon in case of capture, seizure or detention, until after condemnation of the property insured, nor until sixty days after notice of said condemnation is given to these insurers. Also warranted not to abandon in case of blockade, and free from any claim for loss or expense in consequence of blockade, or of any attempt to evade blockade, but in event of blockade to be at liberty to proceed to an open port and there end the voyage."

The frustration clause is another thorn in the side of the underwriter. A large number of banks are declining to accept policies covering war risks, if this clause is included. The argument of the banks is that one of the really serious elements of the situation is the possibility of our Government refusing to permit vessels to sail for the war zone. Subsequent to the *Sanday* decision by the British courts this clause came into general use, despite the fact that that case did not directly involve underwriters. The position of the insurers is that whereas they are willing to cover against the acts of belligerents they do not care to assume liability for losses arising out of the imposition of a government embargo against the sailing of vessels to the Near East. They feel that the banks are already abundantly protected through their rights against the cargo.

Still another source of apprehension is the possibility of shippers making use of a route via Trieste with subsequent transshipments by rail from that port. This involves extra hazards and the likelihood of additional claims and is a situation not contemplated in the original undertaking.

In this connection it is interesting to note that a number of underwriters are making use of an altered war clause that conforms to the requirements of a recent British court decision with respect to liability for seizures of the property of the assured by de facto governments, the latter not being governments in the meaning of the clause. The recent changes are here given in italics: "Including direct loss and/or damage caused by strikers, locked-out workmen or persons taking part in labor disturbances, riots, civil commotions or explosions, the result of unlawful acts, but, notwithstanding anything to the contrary, either expressed or implied herein, or in the policy to which this endorsement is attached, this insurance does not cover and is hereby warranted to exclude claims for delay, deterioration or loss of market, or for confiscation or destruction by the Government, *and/or de facto Government*, of or within the country in which the property is situate and/or the Government, ***and/or*** *de facto Government of seceding or revolting States.*"

Portuguese Revolution Coverage

REQUESTS have been coming in to underwriting offices for insurance against the hazards of revolution in Portugal, and they have chiefly arisen through the insistence of certain banks for protection of this character. Inquiries among steamship lines operating to Portugal and an interview with the Portuguese consul have failed to elicit any information as to why this sudden demand should be made, but shippers must secure the coverage their banks demand. There is a general lack of confidence in the stability of the present Portuguese Government and this is

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somewhat accentuated by the continued depression of Portuguese currency and the recent passage of a very stringent tax law. The insured should bear in mind that the strike and riot clauses most commonly in use in this market do not include the risk of revolutions unless the latter is specially inserted. Underwriters feel that it would be a mistake to include in their general strike and riot clause the risk of revolutions, this being a hazard of much more serious nature than either strikes or riots, and ought to be dealt with separately. The ordinary war clause does not cover on shore, and that is where most damage from a revolution would most likely occur; nor is it certain that damage on sea by revolutionists would be covered inasmuch as such acts would not be committed "in prosecution of hostilities between belligerent nations." Current quotations for insurance against the results of revolutions in Portugal, as applied to shipments, vary from an eighth to a quarter percent.

Bootlegging Hazards

IN these days of wholesale bootlegging and rum-running underwriters are obliged to give careful consideration to hazards thus involved. Suspicion attaches to the surprisingly numerous applications for coverage on yachts and other vessels operating to and from the West Indies. It is believed by underwriters that the warranty as regards illicit and prohibited trade is sufficient to relieve them in the case of most vessels, and that they are further protected against confiscation by the warranty applicable to seizure, arrest, restraint, etc. In the case of yachts, which are so frequently mediums of bootlegging, the restriction that they are to be used for pleasure purposes only, it is felt, is a sufficient protection to the insurer. The illicit trade warranty reads as follows: "It is also agreed that the property be warranted by the assured free from any charge, damage or loss, which may arise in consequence of a seizure or detention, for, or on account of any illicit or prohibited trade, or any trade in articles contraband of war."

W. D. Winter, in his work on "Marine Insurance," says, in this connection:

"It would also appear that there must be read into this clause 'loss—which may arise—for, or on account of any—trade in *the goods hereby insured,*' otherwise an innocent shipper might be prejudiced by the seizure and detention of his goods merely because they happened to be in the same vessel with other goods liable for seizure or detention on account of illicit, prohibited or contraband trade."

Carriers' Liability in Italy

THE Merchants' Association of Genoa recently entered into an arrangement with a number of Italian steamship companies with regard to shortweight in shipments of coffee from Brazil to that port. The arrangement is as follows:

1. Damaged and undamaged bags weighing at least 58,500 kilograms do not call for any claim. If the bags weigh less than 58,500 kilograms a shortweight indemnification will be admitted.

2. For bags showing shortweight the difference in weight will be calculated on the basis of 59,000 kilograms. On the same basis there will also be calculated the difference existing between the weight ascertained when goods are shipped and the weight at the time of discharge.

3. For shortweight thus ascertained steamship companies surrender to consignees as indemnification the net remainder of the loose quantity on board.

4. In case the loose quantity in question is not equal to the entire shortness, the steamship company pays 50 percent of difference in weight according to invoiced original price.

5. Steamship companies, as well as consignees, are engaged to provide the necessary supervision so that all the loose coffee on board and in the lighters is gathered, weighed and delivered to the warehouse of the freeport.

6. The weight of bags with shortweight has to be ascertained within eight days after completion of discharging, for shipments up to 6,000 bags; this period will be extended by one day for every full or commenced lot of 1,500 bags more.

7. This arrangement is in force until revoked and has retrospective effect for steamers which have entered Genoa on or after October 1, 1922.

Insurance of License Suspension

THEY are doing a land-office business in England in the insurance of British sea-going officers against the risk of a suspension of their licenses. This is a new proposition. Policies are being issued by the Navigators and General Insurance Company. For an annual premium of 12s. 6d. the company guarantees the assured during suspension the payment of a monthly sum equaling his monthly salary, and also a full allowance for food, accommodation and attendance of a nature identical with that provided the policyholder at the time of his suspension. The maximum monthly payment is £50.

British Hull Market Active

THERE is a revival of activity in hull coverage in England at this time. Renewals are coming in briskly and, what is of more significance, vessels are being freely written whose insurance does not expire for several months. This is taken as indicating that owners regard prevailing conditions as advantageous for placing their risks. It would appear to suggest either that an impression is at large that rates are likely to advance with the end of the year, or that the market has reached its bottom and that nothing is to be gained by further delay. Underwriters welcome the business, both because it places them on a sounder basis and because it is taken as indicating that shipowners have faith in their ability to keep their vessels employed.

The Sold Wooden Ships

IT has been a matter of gratification to underwriters that the contract under which the 226 wooden Shipping Board vessels were sold requires "that they are not to be used for transportation purposes as steamships, and that they will be promptly dismantled within a reasonable time, after the legal documents have been executed." There is rejoicing in underwriting offices that at last the hour is at hand when insurance companies are no longer to be threatened with extinction for their unwillingness to insure these undesirable risks. By the contract of sale they may be used as barges, but past experience has demonstrated that in most instances the hulls are too heavy for that purpose.

Hazards in Use of Extra Ports

IF additional evidence is required to sustain the position of underwriters that serious extra hazards are involved in the use of additional ports in the passage it is at hand in the case of a steamer that recently sailed from New York for Batavia and deviated via Jacksonville, Fla. On coming out of Jacksonville, she grounded, necessitating her being sent to Newport News for repairs, thus entailing substantial extra expense upon her underwriters in addition to opening the average warranties. Following the heavy losses sustained by underwriters in the deviations made by the steamers *Welsh Prince* and *Jethou*, it is felt that every justification exists for additional charges for the use of ports on the passage.

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Line Shafts for Marine Internal Combustion Engines

By Joseph Hecking*

This article is an analysis made in connection with the revision of the rules of the American Bureau of Shipping for line shafts of internal combustion engines. It will be found of special interest in cases of contemplated conversion from steam to oil engine drive as it shows the flywheel effect and the cylinder sizes and arrangement suitable for retaining existing shafting. In this connection the reader is also referred to Mr. Hecking's article on "Diesel Engine Crankshafts," published in our February, 1921 issue.

THE turning efforts of reciprocating oil engines are subject to wide variations during the period of a cycle. The variations or the ratio of maximum to minimum turning effort is greatest for one-cylinder engines and decreases with the increase in number of cylinders. In order to bring the cranks over the dead centers and over the period when no positive turning effort is produced the fitting of flywheels becomes a necessity. Without a flywheel and without the flywheel effect of the rotating engine parts, engines would come to a sudden stop at the point of the stroke corresponding to the intersection of the resultant turning effort curve with the zero torque line. Where the resultant torque line does not intersect the zero line the fluctuations in speed would be too great for practical purposes, excepting engines with a large number of cylinders.

It is the function of the flywheel to absorb effort when the turning efforts are above the mean and to surrender the absorbed effort when the turning efforts are below the mean, thus tending to equalize the effects of the irregular turning efforts in their transition to perform work. This theory presupposes that the resistance is uniform during the whole cycle, i.e., that the power developed during the power stroke is uniformly absorbed by the propeller. This is, however, not exactly true, as actual torque diagrams taken from various engines have fully demonstrated. There are a number of other considerations such as misfiring, pre-ignition, torsional vibrations, etc., which make it advisable to calculate flywheels with an ample margin of safety.

Excess turning efforts cause an increase in the velocity of the crankpin, and vice versa. The excess over the mean turning effort causes a maximum velocity near the end of the power stroke, representing the accumulation of the excesses at all the momentary crank angles during this stroke, and the deficiency of turning effort causes a minimum velocity near the beginning of the power stroke. Inasmuch as the power generated is equal to the resistance, the increase in the velocity at the end of the power stroke represents the excess of power E developed during this stroke and is equal to the kinetic energy of the flywheel.

Energy Stored in Flywheel

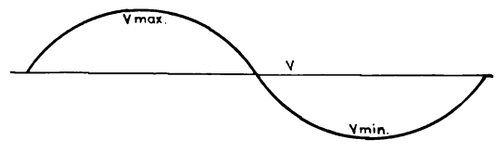
The kinetic energy in foot-pounds stored in a flywheel is approximately:

$$E = \frac{W V^2}{2g} \qquad (1)$$

wherein, W = Weight of flywheel rim in pounds.
V = Velocity in feet per second of the wheel's periphery
g = Acceleration = 32.16

By taking the weight of the rim only and the velocity of the outside diameter in place of the center of gravity the kinetic energy of the wheel is somewhat overrated; but the hub and arms of the wheel, as also the rotating masses of the engine proper, produce kinetic energy which is generally ignored in flywheel calculations. As an additional margin of safety the indicated power has been taken as the basis of calculations, ignoring the friction losses in cylinders and bearings and also the power absorbed by attached auxiliaries. The power delivered to the lineshaft, i.e., the shaft horsepower, is from 70 to 80 percent of the indicated horsepower and the flywheel effect based on rim weight and peripheral velocity is considered to safely cover all conditions.

The fluctuation C above and below the normal velocity of the crankpin, due to the irregular turning efforts, is indicated in Sketch 1. It is evident that the greater the fluctuation the smaller the flywheel effect and the greater the irregularity of the effect of the turning efforts. The kinetic energy to be stored in a flywheel for a predetermined fluctuation depends on the difference in the extreme velocities squared or $V\ max.^2 - V\ min.^2$ This fluctuation C is best expressed in terms of the mean velocity V and may be determined as follows:



Sketch 1.—Showing Fluctuations in Velocity of Crank Pin

$$C = \frac{V\ max. - V\ min.}{V}\ ;\ \text{or}\ V\ max. - V\ min. = C\ V$$

$$\frac{V\ max. + V\ min.}{2} = V;\ \text{or}\ V\ max. + V\ min. = 2\ V$$

$$(V\ max. - V\ min.)\ (V\ max. + V\ min.) = C\ V \times 2\ V$$

$$V\ max.^2 - V\ min.^2 = 2\ C\ V^2$$

Inserting this value in formula (1) the required flywheel effect to produce a required kinetic energy E under a predetermined speed fluctuation C, is

$$E = \frac{W 2 C V^2}{2g} = \frac{W C V^2}{g} \qquad (2)$$

If R = Revolutions of engine per minute and
F = Outside diameter of flywheel in feet,

Then $V^2 = \left(\frac{F\pi R}{60}\right)^2 = \frac{F^2\pi^2R^2}{60^2} = \frac{F^2R^2}{365}$;

Inserted in equation (2),

$$E = \frac{W C F^2 R^2}{32.16 \times 365};$$

If W = weight of the flywheel in thousands of pounds

$$E = \frac{1{,}000\ W C F^2 R^2}{32.16 \times 365} = \frac{W C F^2 R^2}{11.75}$$

E is expressed in foot-pounds, but the diameter and stroke of engines (functions of E) are always expressed in inches. With E in inch-pounds

$$E = \frac{W C F^2 R^2 \times 12}{11.75} = W C F^2 R^2 \text{ (nearly)} \qquad (3)$$

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Table I

Stroke	Crank Angle	Press. Per Sq. In. Piston Area	Press. in Percent of Max. Press. 500 Lbs.	Piston Load = Percent Press. × .7854 D^2	Torque Arm in Percent of Stroke	Turning Moment in Percent of D^2PS	S = Turning Force D^2PS/r
Power	Top	391	.782 P	.614 D^2P	—	—	— D^2P
	15	397	.794	.623	.1575	.098 D^2PS	.196
	30	319	.638	.502	.298	.150	.300
	45	193	.386	.303	.410	.125	.250
	60	119	.238	.187	.482	.090	.180
	75	91	.182	.143	.511	.073	.146
	90	94	.188	.148	.500	.074	.148
	105	100	.200	.157	.455	.072	.144
	120	106	.212	.166	.384	.064	.128
	135	112	.224	.176	.297	.052	.104
	150	115	.230	.181	.202	.037	.074
	165	119	.238	.187	.102	.019	.038
	180	112	.224	.176	—	—	—
Exhaust	195	- 78	- .156	- .123	.102	- .013	- .026
	210	- 75	- .150	- .118	.202	- .023	- .046
	225	- 69	- .138	- .108	.297	- .032	- .064
	240	- 57	- .114	- .090	.384	- .035	- .070
	255	- 41	- .082	- .064	.455	- .029	- .058
	270	- 15	- .030	- .024	.500	- .012	- .024
	285	+ 9	+ .018	+ .014	.511	+ .007	+ .014
	300	37	.074	.058	.482	.028	.056
	315	66	.132	.104	.410	.043	.086
	330	91	.182	.143	.298	.042	.084
	345	103	.206	.162	.157	.025	.050
	360	109	.218	.171	—	—	—
Suction	15	- 103	- .206	- .162	.157	- .025	- .050
	30	- 91	- .182	- .143	.298	- .042	- .084
	45	- 66	- .132	- .104	.410	- .043	- .086
	60	- 37	- .074	- .058	.482	- .028	- .056
	75	- 9	- .018	- .014	.511	- .007	- .014
	90	+ 15	+ .030	+ .024	.500	+ .012	+ .024
	105	41	.082	.064	.455	.029	.058
	120	57	.114	.090	.384	.035	.070
	135	69	.138	.108	.297	.032	.064
	150	75	.150	.118	.202	.023	.046
	165	78	.156	.123	.102	.013	.026
	180	81	.162	.127	—	—	—
Compression	195	- 78	- .156	- .123	.102	- .013	- .026
	210	- 75	- .150	- .118	.202	- .023	- .046
	225	- 69	- .138	- .108	.297	- .032	- .064
	240	- 57	- .114	- .090	.384	- .035	- .070
	255	- 44	- .088	- .069	.455	- .031	- .062
	270	- 25	- .050	- .039	.500	- .019	- .038
	285	- 9	- .018	- .014	.511	- .007	- .014
	300	0	—	—	.482	—	—
	315	- 18	- .036	- .028	.410	- .013	- .026
	330	- 81	- .162	- .127	.298	- .038	- .076
	345	- 190	- .380	- .298	.157	- .047	- .094

Table II

Stroke	Crank Angle	Press. Per Sq. In. Cylinder	Press. in Percent of Max. P 350 Lbs.	Piston Load, Percent of D^2P	Torque Arm, Percent of Stroke	Turning Moment, Percent of D^2PS	Turning Force D^2PS/r
							D^2P
Power	0	261	.745	.585	—	—	
	15	233	.665	.552	.1575	.087	.163
	30	181	.517	.405	.298	.120	.240
	45	130	.372	.292	.410	.119	.239
	60	92	.263	.206	.482	.099	.198
	75	77	.220	.173	.511	.088	.177
	90	75	.214	.168	.500	.084	.168
	105	80	.228	.179	.455	.081	.163
	120	83	.237	.186	.384	.071	.143
	135	86	.246	.193	.297	.057	.114
	150	77	.220	.173	.202	.035	.070
	165	70	.200	.157	.102	.016	.032
	180	67	.191	.150	—	—	—
Exhaust	195	- 66	- .189	- .148	.102	- .015	- .030
	210	- 64	- .183	- .143	.202	- .029	- .058
	225	- 59	- .168	- .132	.297	- .039	- .078
	240	- 50	- .143	- .112	.384	- .043	- .086
	255	- 36	- .103	- .081	.455	- .037	- .074
	270	- 16	- .046	- .037	.500	- .018	- .037
	285	+ 9	+ .026	+ .020	.511	+ .010	+ .020
	300	33	.092	.072	.482	.035	.069
	315	56	.160	.125	.410	.051	.102
	330	73	.209	.164	.298	.049	.098
	345	84	.240	.188	.157	.030	.059
	360	88	.252	.198	—	—	—
Suction	15	- 84	- .240	- .188	.157	- .030	- .059
	30	- 73	- .209	- .164	.298	- .049	- .098
	45	- 56	- .160	- .125	.410	- .051	- .102
	60	- 33	- .092	- .072	.482	- .035	- .069
	75	- 9	- .026	- .020	.511	- .010	- .020
	90	+ 16	+ .046	+ .037	.500	+ .018	+ .037
	105	36	.103	.081	.455	.037	.074
	120	50	.143	.112	.384	.043	.086
	135	59	.168	.132	.297	.039	.078
	150	64	.183	.143	.202	.029	.058
	165	66	.189	.148	.102	.015	.030
	180	67	.191	.150	—	—	—
Compression	195	- 66	- .189	- .148	.102	- .015	- .030
	210	- 64	- .183	- .143	.202	- .029	- .058
	225	- 59	- .168	- .132	.297	- .039	- .078
	240	- 53	- .151	- .118	.384	- .045	- .091
	255	- 41	- .117	- .092	.455	- .042	- .084
	270	- 26	- .074	- .058	.500	- .029	- .058
	285	- 8	- .023	- .018	.511	- .009	- .018
	300	+ 6	+ .017	+ .013	.482	+ .006	+ .012
	315	+ 6	+ .017	+ .013	.410	+ .005	+ .011
	330	- 13	- .037	- .029	.298	- .009	- .017
	345	- 42	- .120	- .094	.157	- .015	- .029

Table III

Stroke	Crank Angle	Pressure Per Square Inch	Press. in Percent of Max. Press. P	Piston Load Percent Max. Press. × .7854 D^2	Torque Arm Percent of Stroke S	Turning Moment Percent of D^2PS	S = Turning Force D^2PS/r
Power	0	212	.707 P	.555 PD^2	—	—	—
	15	161	.536	.420	.1575	.066	.132 D^2P
	30	105	.350	.275	.298	.082	.164
	45	67	.223	.175	.410	.072	.144
	60	50	.167	.131	.482	.063	.126
	75	49	.163	.128	.511	.065	.131
	90	56	.187	.147	.500	.073	.147
	105	64	.213	.167	.455	.076	.152
	120	73	.243	.191	.384	.073	.147
	135	72	.240	.188	.297	.056	.112
	150	67	.223	.175	.202	.035	.070
	165	69	.230	.181	.102	.018	.037
	180	70	.233	.183	—	—	—
Exhaust	195	- 69	- .230	- .181	.102	- .018	- .037
	210	- 67	- .223	- .175	.202	- .035	- .070
	225	- 62	- .207	- .163	.297	- .048	- .097
	240	- 52	- .173	- .136	.384	- .052	- .104
	255	- 36	- .120	- .094	.455	- .043	- .086
	270	- 14	- .047	- .037	.500	- .018	- .037
	285	+ 11	+ .037	+ .029	.511	+ .015	+ .030
	300	33	.110	.086	.482	.041	.082
	315	55	.183	.144	.410	.059	.118
	330	72	.240	.188	.298	.051	.102
	345	82	.273	.214	.157	.034	.067
	360	88	.293	.230	—	—	—
Suction	15	- 82	- .273	- .214	.157	- .034	- .067
	30	- 72	- .240	- .188	.298	- .051	- .102
	45	- 55	- .183	- .144	.410	- .059	- .118
	60	- 33	- .110	- .086	.482	- .041	- .082
	75	- 11	- .037	- .029	.511	- .015	- .030
	90	+ 14	+ .047	+ .037	.500	+ .018	+ .037
	105	36	.120	.094	.455	.043	.086
	120	52	.173	.136	.384	.052	.104
	135	62	.207	.163	.297	.048	.097
	150	67	.223	.175	.202	.035	.070
	165	69	.230	.181	.102	.018	.037
	180	70	.233	.183	—	—	—
Compression	195	- 69	- .230	- .181	.102	- .018	- .037
	210	- 67	- .223	- .175	.202	- .035	- .070
	225	- 62	- .207	- .163	.297	- .048	- .097
	240	- 53	- .177	- .139	.384	- .053	- .107
	255	- 41	- .137	- .108	.455	- .049	- .098
	270	- 25	- .083	- .065	.500	- .032	- .065
	285	- 11	- .037	- .029	.511	- .015	- .030
	300	- 1	- .004	- .003	.482	- .001	- .003
	315	- 5	- .017	- .014	.410	- .006	- .012
	330	- 34	- .113	- .089	.298	- .026	- .053
	345	- 92	- .307	- .241	.157	- .038	- .076

Determination of E for Diesel Engines

The curve of the turning efforts is determined from the indicator card with due consideration of the inertia forces of the reciprocating engine parts. Turning effort diagrams of theoretical or prospective engines are subject to the errors of assumptions and the laying-out of the same requires, therefore, experience and good judgment. Diagrams for general application can only be based on average values and should be checked for each design, especially in cases of material departure from the basic assumption.

Ordinary Diesel engines run normally with a mean indicated pressure of about 100 pounds per square inch piston area, the back or compression pressure considered, and this pressure may be taken as the basis of flywheel calculations. The slight variation in pressures during the exhaust and suction strokes of four cycle engines may be ignored. Based on a maximum working pressure, P, of 500 pounds the mean indicated pressure (m.i.p.) is, therefore, 0.2 the maximum pressure or 0.2 P. Assuming that the resistance is uniform, the power developed during the power stroke is uniformly consumed during one cycle, which consists of two revolutions for four cycle engines and one revolution for two cycle engines.

If m represents the mean crank pin pressure per square inch of cylinder area and r length of crank in feet, then $2r$ = stroke S of engine and

$$.2P \times 2r = m \times 2r\pi \times 2$$
$$m = .0318\ P \text{ (4 cycle 1 cylinder)}$$
$$.2P \times 2r = m \times 2r\pi;$$
$$m = .0636\ P \text{ (2 cycle 1 cylinder).}$$

The mean turning force relative to the crank circle is

$$.0318\ P \times .7854\ D^2 = .025\ D^2P \text{ (4 cycle 1 cylinder)}$$
$$.0636\ P \times .7854\ D^2 = .050\ D^2P \text{ (2 cycle 1 cylinder)}$$

wherein D = diameter of cylinder in inches.

The above mean indicated cylinder pressure is based on the net output of the cylinder. The work done during the power stroke covers, in addition to the uniform propeller resistance, the resistance of the compression stroke. The mean indicated pressure of the latter varies between 40 and 50 pounds per square inch of cylinder area. Taking an average of 45 pounds, the total mean indicated pressure of the power stroke is 100 + 45 = 145 pounds and the equivalent mean crankpin pressure m during this stroke $145 \times 2r = m \times r\pi$;

$$m = 290/\pi = 92.35 \text{ pounds} = .185\ P.$$

The mean turning force of the power stroke is

$.185\ P \times .7854\ D^2 = .145\ D^2P$ for 4 and 2 cycle engines and the total work done during this stroke based on the crank path

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$\left(r\pi = \frac{S}{2}\pi\right)$ is $.145\ D^2P \times \pi S/2 = .228\ D^2PS$.

The uniform resistance of $.025\ D^2P$ (4 cycle) covers a mean length of $.065$ of the power stroke area or $.965\ \pi S/2$ and its work is

$$.025\ D^2P \times .965\ \pi S/2 = .038\ D^2PS$$

leaving an excess power

$$E = (.228 - .038)\ D^2PS = .190\ D^2PS \text{ (4 cycle 1 cylinder)} \quad (4).$$

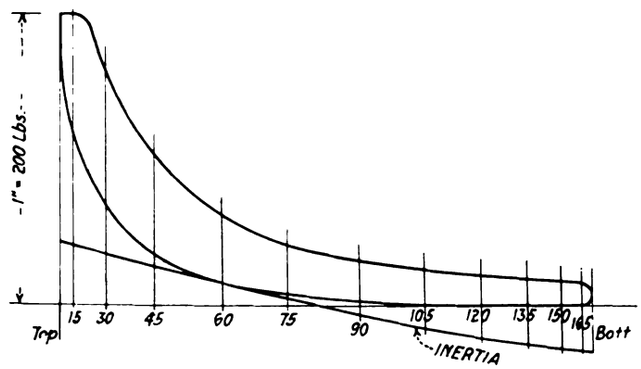

Fig. 3.—Maximum Initial Pressure, 300 Pounds=P; Mean dicated Pressure, 100 Pounds; Mean Compression Pressure, 45 Pounds

The uniform resistance of $.050\ D^2P$ (2 cycle) covers a mean length of $.935$ of the power stroke area or $.935\ \pi S/2$ and its work is

$$.050\ D^2P \times .935\ \pi S/2 = .073\ D^2PS$$

leaving an excess power

$$E = (.228 - .073)\ D^2PS = .155\ D^2PS \text{ (2 cycle 1 cylinder)} \quad (5).$$

E Determined from Torque Diagrams for Diesel Engines

In multi-cylinder engines the work performed by each cylinder is of equal magnitude and the above noted mean

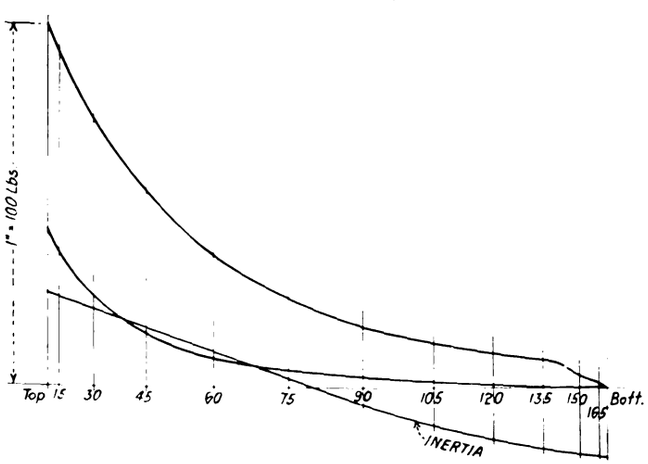

Fig. 2.—Maximum Initial Pressure, 350 Pounds=P; Mean Indicated Pressure, 75 Pounds; Mean Compression Pressure, 25 Pounds

turning efforts of one cylinder may be multiplied by the number of cylinders in order to obtain the combined mean turning effort. It is, however, much easier to determine the excess power by planimetering the excess power area of torque diagrams.

The indicator card in Fig. 1 has the mean pressures above referred to as basic assumptions and the various readings of this card are tabulated in Table I. The torque arm (sixth column) has been determined by the graphical method, described in the author's article in MARINE ENGINEERING AND SHIPPING AGE of April, 1922. The connecting rod/crank length ratio of 4.5 has been used in this analysis as representing the average practice. The seventh column contains the turning moments, being the product of the piston load and the torque arm at the respective crank angle. The last column contains the turning force, i.e., the turning moment divided by the crank length, r. The accuracy of the measurements of the card may be checked by summing the values in the last column and dividing by the total number of crank positions. For a four cycle engine (1 cylinder) the average of the 4 strokes should be $.025\ P\ D^2$ and for the two cycle engine (1 cylinder) $.050\ P\ D^2$ in accordance with the results arrived at above mathematically.

The turning effort diagrams of 4 and 2 cycle engines are shown on Charts 1 and 2 as noted. The abscissæ represent the crank angles for one complete cycle, 2 revolutions for the 4 cycle engine and one revolution for the 2 cycle engine, having one cylinder. The ordinates represent the turning forces at the various crank angles, as given in the last column of Table I. For multi-cylinder engines one complete cycle is covered by the crankpath of $720/n$ degrees in

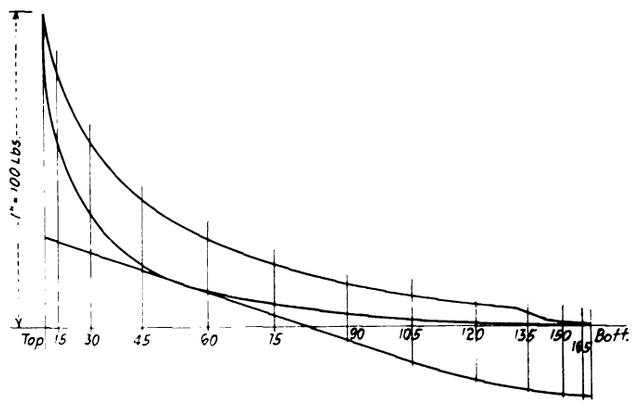

Fig. 3.—Maximum Initial Pressure, 300 Pounds=P; Mean Indicated Pressure, 35 Pounds; Mean Compression Pressure, 32 Pounds

the case of 4 cycle engines and by $360/n$ in the case of 2 cycle engines where n = number of cylinders. Thus a complete diagram of a 6 cylinder 4 cycle engine may be shown on a diagram of 720/6 = 120 degrees; the turning forces in PD^2 (column 8 Table I) of the various cranks must be combined in their proper relation; i.e., the efforts of 30—150—270—30—150—270 will fall on the same abscissa, marked 30.

The mean turning force line divides the curve into two equal parts, the areas above the mean line are equal to the areas below. Its height above the zero torque line, represents the force in terms of D^2P. Multiplied by the length in terms of $\pi S/2$ gives the work done during one cycle. Thus $.025\ D^2P \times 2r\pi \times 2 = .157\ D^2PS$ is the work of one cycle of a 4 cycle one cylinder engine, and $.050\ D^2P \times 2r\pi = .157\ D^2PS$ is the work of one cycle of a 2 cycle one cylinder engine.

In order to avoid confusion, the curves of the turning efforts of the individual cylinders have been omitted on the diagrams for engines with a large number of cylinders and the resultant curves, shown in heavy lines, have been obtained by adding the proper values in the last column of Table I. The excess energy of the power stroke is the shaded area marked E above the mean turning force line. Its area has been determined by multiplying the mean height

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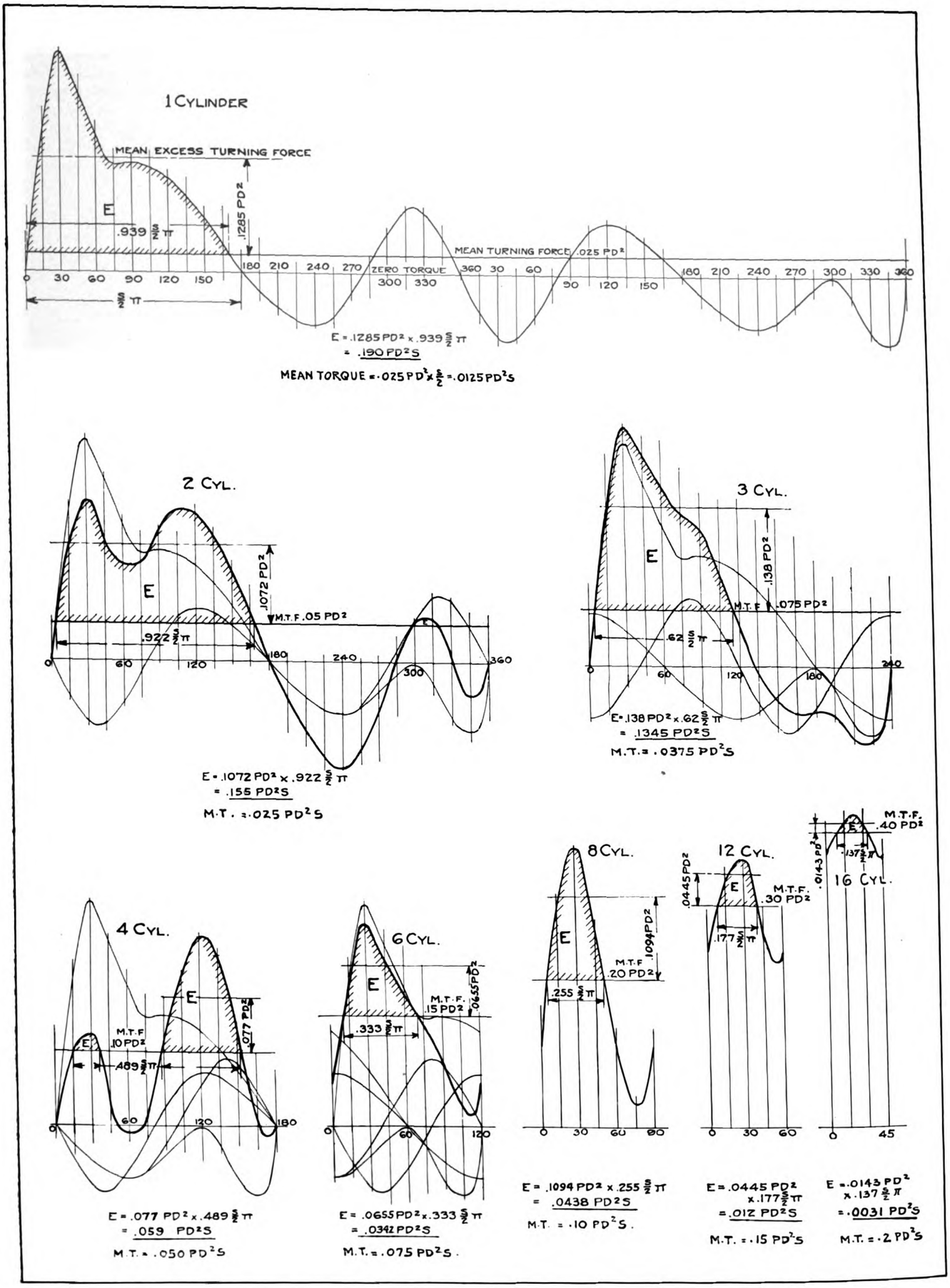

Chart 1.—Turning Effort Diagrams. Four Cycle Diesel Engines

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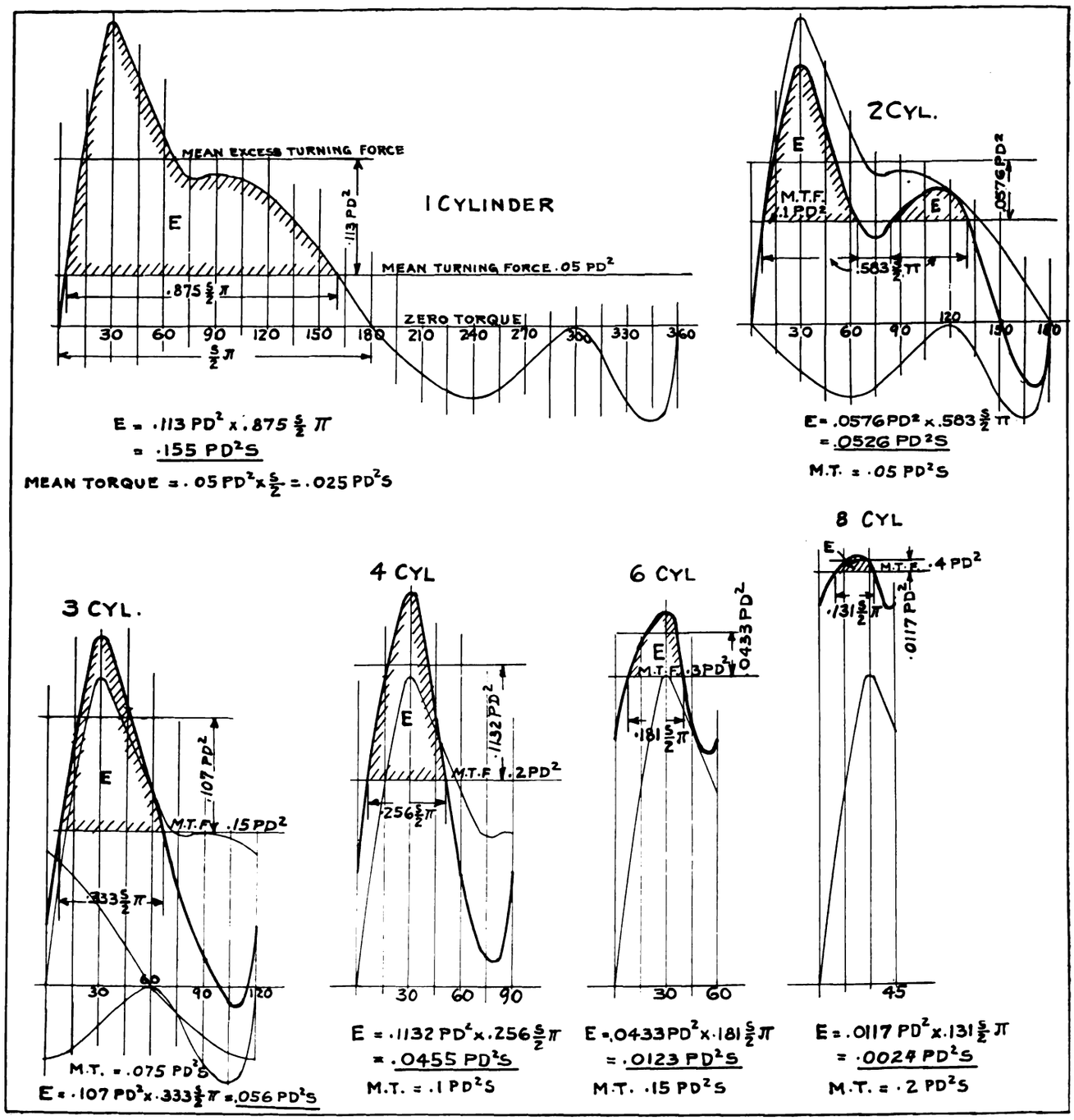

Chart 2.—Turning Effort Diagrams. Two Cycle Diesel Engines

in terms of the piston load PD^2 by the length in terms of the crankpath $S/2\pi$, the product being a percentage of D^2PS or KD^2PS. For general application refinement in the use of the excess area values E is out of order in view of the fact that varying compression and inertia may change the same to a minor degree and the values of K given in the following table may be considered a fair average, being the actual values noted on the charts rounded upwardly, i.e., on the safe side.

VALUES OF K FOR DIESEL ENGINES

No. of Cylinders	1	2	3	4	6	8	12	16
4 cycle	.190	.155	.135	.060	.040	.045	.015	.005
2 cycle	.155	.055	.055	.045	.015	.005	....	....

By substituting KD^2PS for E in formula 3 the main formula for flywheel effect is obtained

$$KD^2PS = W\ C\ F^2\ R^2 \quad (6)$$

from which the fluctuation C for any existing flywheel or the diameter and weight (W F) of the flywheel for a desired fluctuation may be determined for any Diesel engine.

DETERMINATION OF E FOR EXPLOSIVE COMBUSTION ENGINES

The mean indicated and the mean compression pressures for engines other than Diesel type cover a much wider range than those for Diesel engines. The considerable difference is plainly shown by the two indicator cards, Fig. 2 and Fig. 3, the former having a mean indicated pressure of 75 pounds and the latter of 35 pounds, which pressures are not the extreme limits. It is not the scope of this article to discuss the causes and effects of this wide difference in the design of explosive combustion engines. For the purpose of establishing the values of E for the required flywheel effect it is considered advisable to use Fig. 2, which gives

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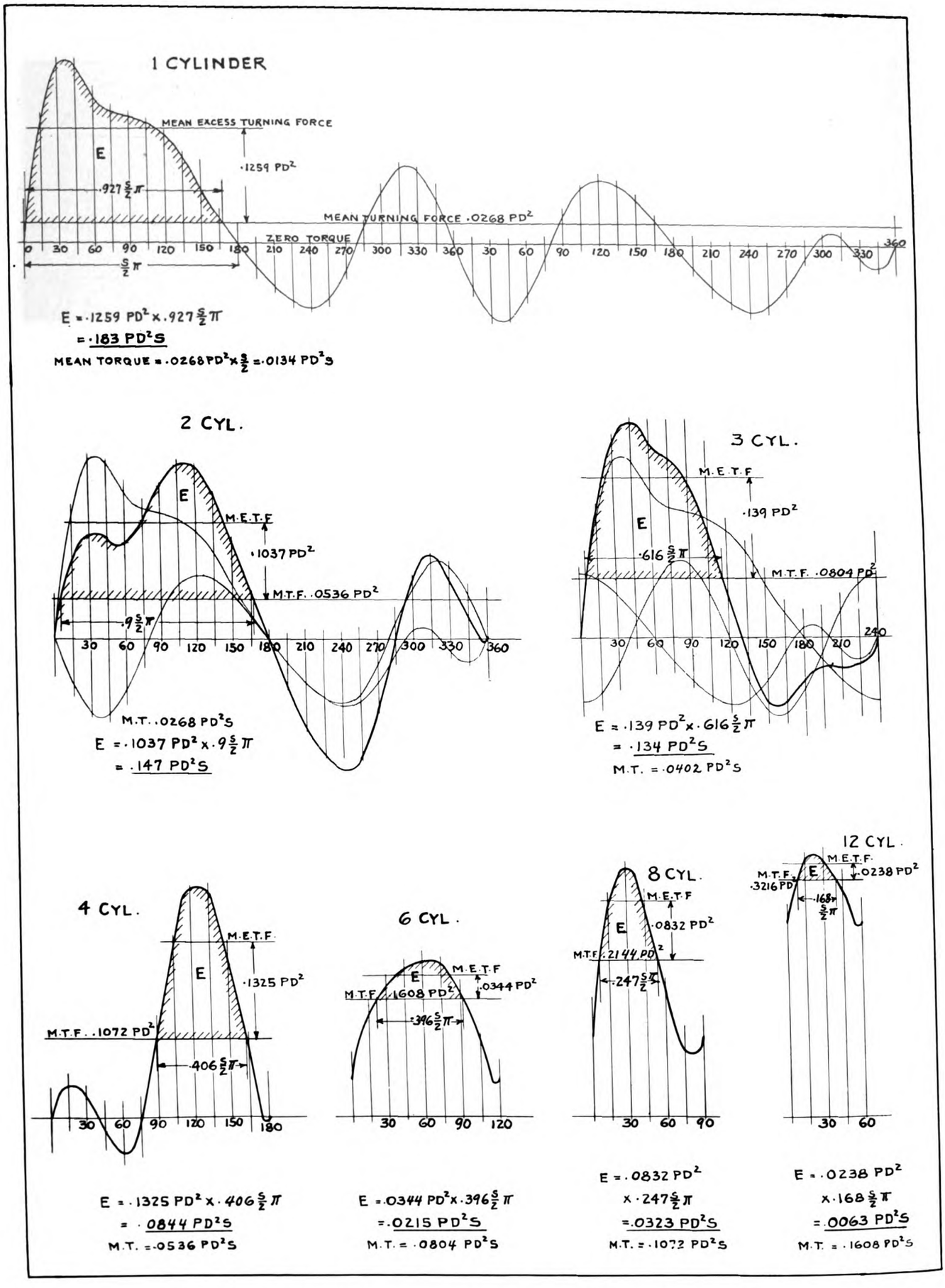

Chart 3.—Turning Effort Diagrams. Four Cycle Explosive Combustion Engines

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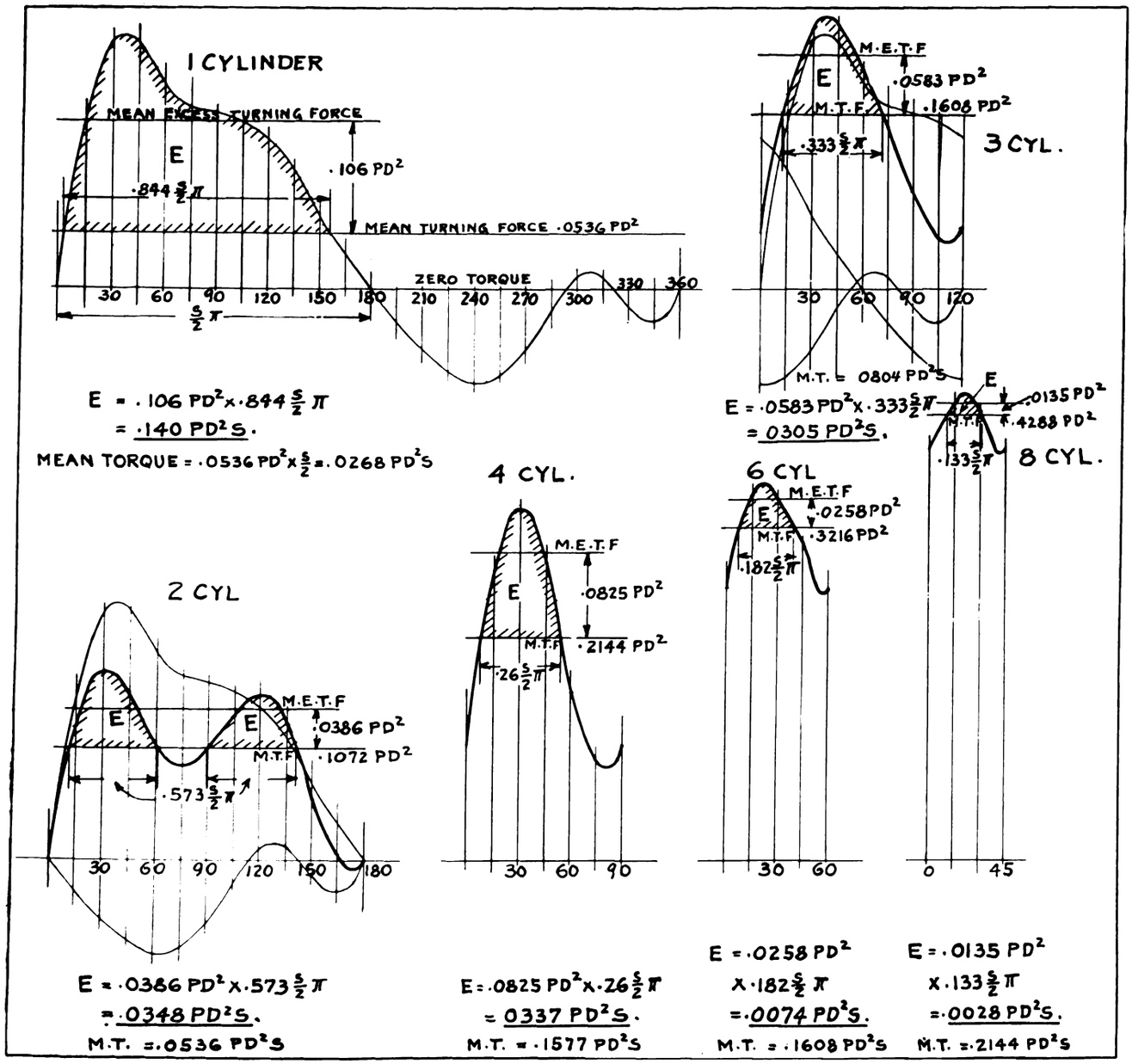

Chart 4.—Turning Effort Diagrams. Two Cycle Explosive Combustion Engine

somewhat larger values. Using the data given in Table II and Fig. 2 the excess area E for one cylinder engines are here briefly analyzed.

Maximum initial pressure P = 350 pounds.
Mean indicated pressure 75 pounds.
Mean compression pressure 25 pounds.
Mean power stroke pressure 75 + 25 = 100 pounds.
Mean crankpin pressure =

$$\frac{75 \times 2r}{2 \times 2r\pi} = 11.94 \text{ pounds} = .0311\ P \text{ (4 cycle)}$$

Mean crankpin pressure =

$$\frac{75 \times 2r}{2r\pi} = 23.88 \text{ pounds} = .0682\ P \text{ (2 cycle)}$$

Mean turning force =

$$.0311\ P \times .7854\ D^2 = .0268\ PD^2 \text{ (2 cycle)}$$

Mean turning force =

$$.0682\ P \times .7854\ D^2 = .0536\ PD^2 \text{ (2 cycle)}$$

Mean crankpin pressure during power stroke =

$$\frac{100 \times 2r}{r\pi} = 63.7 \text{ pounds} = .182\ P$$

Mean turning force during power stroke =

$$.182\ P \times .7854\ D^2 = .1427\ PD^2$$

The excess work of the power stroke =

$$(.1427 - .0268)\ PD^2 \times \frac{S}{2}\pi = .183\ D^2PS \text{ (4 cycle)} \quad (7)$$

$$(.1427 - .0536)\ PD^2 \times \frac{S}{2}\pi = .140\ D^2PS \text{ (2 cycle)} \quad (8)$$

E Determined from Torque Diagrams for Explosive Combustion Engines

In the same manner as described under Diesel engines the turning efforts of the indicator card Fig. 2 and Table II, are shown on Charts 3 and 4, for four cycle and two cycle engines. The following table gives the round figures for values of K which may safely be used to calculate the flywheel effect in connection with formula 6.

VALUES OF K FOR EXPLOSIVE COMBUSTION ENGINES

No. of Cylinders	1	2	3	4	6	8	12
4 cycle	.180	.150	.135	.090	.030	.035	.010
2 cycle	.150	.045	.035	.035	.010	.003	....

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EFFECT OF VARYING FLUCTUATION ON DIAMETER OF LINE SHAFTING

It has been previously stated that the power developed during the power stroke is uniformly absorbed by the propeller. Were it possible for an engine to have a flywheel of sufficient size and weight to absorb all the excess power of the power stroke the fluctuation would be zero and the shaft would be designed for uniform torque. But a glimpse at formula 6 will show the impossibility inasmuch as a zero torque will require a flywheel of an infinite diameter × weight. The uniform torque may, however, be used as a starting point from which shaft diameters for varying fluctuations can be calculated and the basic formula for this condition is

Shaft torque modulus × fibre stress = uniform (mean) torque. If d = diameter of shaft and the fibre stress = 5,000 pounds per square inch, $.196\ d^3 \times 5{,}000 = uniform\ torque$.

The uniform torque is the mean turning force noted on the diagrams multiplied by the length of the crank $S/2$. Thus for a 3 cylinder 4 cycle Diesel engine

$$.196\ d^3 \times 5{,}000 = .075\ PD^2 \times S/2 = .0375\ PD^2S$$

$$d = \sqrt[3]{\frac{.0375\ PD^2S}{.196 \times 5{,}000}} \qquad (9)$$

But uniform torque T implies uniform velocity. Energy, however, increases as the increase in velocity squared. The increase in velocity is equal to one-half the fluctuation C as noted in the section on speed fluctuation. If the velocity for uniform torque T is unity, the total torque T_1 for any increase in velocity $= T\ (1 + C/2)^2$. For example, $C = .1$, $T_1 = T\ (1 + .05)^2 = 1.1T$ (nearly). Within the practical limits of C, $(1 + C/2)^2$ is nearly equal to $(1 + C)$ and it will be sufficiently correct to make $T_1 = T(1 + C)$.

Continuing the example of formula (9) for a fluctuation $C = .1$ the torque $.375\ P\ D^2S$ is increased to $1.1 \times .0375\ P\ D^2S = .0413\ P\ D^2S$ and

$$d = \sqrt[3]{\frac{.0413\ P\ D^2S}{.196 \times 5{,}000}} = .595 \sqrt[3]{\frac{PD^2S}{5{,}000}} \qquad (10)$$

The value under the cube root sign is a constant applicable to engines with any number of cylinders and the numerical value before the root sign a variable depending on the number of cylinders, the cycle, and the fluctuation. It is advisable to retain the fibre stress = 5,000 in the formula in order to permit the ready insertion of a higher or lower stress, depending whether a material of a better or of an inferior quality than the ordinary marine steel of 60,000 pounds minimum tensile strength is used. For material having a minimum tensile strength of 70,000 pounds 5,300 may be used in the place of 5,000. Denoting the variable factor as "b" the formula takes the general form of

$$d = b \sqrt[3]{\frac{D^2PS}{5{,}000}}$$

The value "b" may be tabulated as shown in Table IV.

TABLE IV

VALUES OF b FOR DIESEL ENGINES

No. of cylinders	4 cycle / 2 cycle	1 / ..	2 / 1	3 / ..	4 / 2	6 / 3	8 / 4	12 / 6	16 / 8	.. / 12
$C = 0$; $T_1 = T$		.399	.503	.576	.635	.726	.799	.915	1.007	1.153
$C = .05$; $T_1 = 1.05\ T$		.406	.512	.586	.645	.738	.812	.930	1.023	1.172
$C = .1$; $T_1 = 1.1T$		.412	.520	.595	.655	.750	.825	.944	1.038	1.191
$C = .15$; $T_1 = 1.15\ T$		.419	.528	.604	.665	.761	.837	.958	1.053	1.208

For values of b for intermediate fluctuations it will be sufficiently correct to interpolate between the values given, but it will be more accurate to determine T_1 and solve for b in accordance with formula 10.

In a similar manner tables of b values may be calculated for explosive combustion engines, but on account of the wide difference in the mean indicated pressures, which would necessitate a number of tables for engines of different characteristics another method of calculating shaft diameters applicable to all engines is given in the following—

GENERAL FORMULA FOR DETERMINATION OF LINE SHAFT DIAMETERS

p = Mean indicated pressure (from indicator card or by design).
p_e = Mean turning pressure (crankpin).
r = Length of crank in inches; stroke $S = 2r$.
D = Diameter of cylinders in inches.

$$p \times 2r = p_e \times 2r\pi \times 2$$
$$p_e = .16p \text{ (4 cycle)}$$
$$p \times 2r = p_e \times 2r\pi$$
$$p_e = .32p \text{ (2 cycle)}$$

Mean turning force =
$.16\ p \times .7854\ D^2 = .125\ p\ D^2$ (4 cycle)
Mean turning force =
$.32\ p \times .7854\ D^2 = .25\ p\ D^2$ (2 cycle)
Mean turning moment =
$.125\ p\ D^2 \times S/2 = .0625\ p\ D^2S$ (4 cycle)
Mean turning moment =
$.25\ p\ D^2 \times S/2 = .125\ p\ D^2S$ (2 cycle)

Torsional resistance of shaft with fibre stress of 5,000 pounds per square inch =

$$.196\ d^3 \times 5{,}000$$

For 1 cylinder 4 cycle

$$.196\ d^3 \times 5{,}000 = .0625\ p\ D^2S.$$

$$d = \sqrt[3]{\frac{.0625\ p\ D^2S}{.196 \times 5{,}000}} = .683 \sqrt[3]{\frac{p\ D^2S}{5{,}000}}$$

For 1 cylinder 2 cycle

$$d = \sqrt[3]{\frac{.125\ p\ D^2S}{.196 \times 5{,}000}} = .861 \sqrt[3]{\frac{pD^2S}{5{,}000}}$$

The torque produced by each cylinder of multi-cylinder engines is of equal magnitude and the value under the cube root may be multiplied by the number of cylinders, N, in order to obtain the combined mean torque;

Thus for 4 cycle engines

$$d = .683 \sqrt[3]{\frac{pD^2SN}{5{,}000}}$$

The torque varies as the square of the speed. Shafts are designed for maximum torque and the increase in torque T due to the speed fluctuation above normal is

$$T \times \left(\frac{C}{2}\right)^2$$

and the total torque T_1 for any fluctuation $= T(1 + C/2)^2$.

For example: For $C = .1$ the excess speed $= .05$ and the corresponding torque $T_1 = T \times 1.05^2 = 1.1\ T$ (nearly).

Within the customary limits of speed fluctuations C it will suffice to multiply the mean torque value under the cube root sign by $(1 + C)$ in order to obtain the maximum torque T_1.

The final formula will then read:—

For 4 cycle engines

$$d = .683 \sqrt[3]{\frac{p\ D^2\ S\ N}{5{,}000}} \qquad (11)$$

For 2 cycle engines

$$d = .861 \sqrt[3]{\frac{p\ D^2\ S\ N}{5{,}000}} \qquad (12)$$

It will be noted that p is based on the indicated power and not on the brake power. In view of the many extraordinary conditions which may occur in the operation of internal combustion engines it is considered advisable to retain this margin of safety. For engines designed for considerable overload a liberal percentage of the overload mean indicated pressure should be considered in the calculations for shaft sizes.

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Shafts calculated by these formulæ are considered subject to torque only, such as line shafts. Shafts subject to bending stress in addition to torque, such as for generators, pumps, etc., should be calculated for the equivalent bending moment by the well known formula

$$Me = .35\ B + .65\ \sqrt{B^2 + T^2}$$

Wherein

Me = Equivalent bending moment.
B = Bending moment = $WL/6$.
L = Distance in inches between centers of bearings.
W = Weight, carried by shaft in pounds.
T = Twisting moment, (or T_1) derived as shown above.

The modulus of resistance for bending is $.098\ d^3 \times 5{,}000$.

$$.098\ d^3 \times 5{,}000 = .35\ B + .65\ \sqrt{B^2 + T^2}$$

and

$$d = \sqrt[3]{\frac{.35\ B + .65\ \sqrt{B^2 + T^2}}{.098 \times 5{,}000}}$$

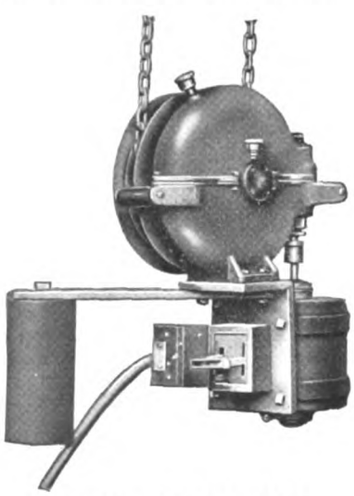
$$= .128\ \sqrt[3]{.35\ B + .65\ \sqrt{B^2 + T^2}} \quad (13)$$

The fibre stress of 5,000 pounds per square inch represents the regular marine steel of 60,000 pounds tensile strength; where material of 70,000 pounds tensile strength is used, 5,300 may be substituted for 5,000.

The author takes this opportunity to express his appreciation for the kind cooperation of the engine builders, notably Worthington Company, McIntosh-Seymour, Standard Motor Construction Company and others to a lesser degree, by placing valuable data at his disposal.

Electric Chain Haul for Hand Hoists

AN electric machine now manufactured by the New Jersey Foundry and Machine Company, 90 West street, New York, will be of interest to users of hand power hoists of 5 tons and larger capacity. This machine may be suspended in the bight of the operating chain and will overhaul 128 feet of hand chain per minute and give a chain a pull of 130 pounds. This permits a load lifting speed of



"Handiman" Chain Haul

approximately four times that obtainable by hand power and but one man is required for operating.

Current is supplied to the unit by a flexible conductor attached to convenient sockets or it may be suspended from the hoist if it is more desirable to bring the feeders to that point. The machine is self-balancing, weighs about 160 pounds and can be furnished for operation on either alternating or direct current. Hardened gears are used throughout running in an oil bath.

Public Health Service Requirements for a Sanitary System of Drinking, Cooking and Ablutionary Water Supplies on Vessels

ALL vessels engaged in interstate traffic or handling passengers traveling interstate, or freight which is being transported interstate, are subject to the Interstate Quarantine Regulations of the United States. Special requirements have been prepared for the supervision of the water supplies used for drinking and culinary purposes on such vessels, subject to these regulations. In order that unnecessary and expensive changes, often requiring delay of vessels from their regular business, may be avoided, the following information is herewith prepared for the guidance of naval architects and the managing officials and designing engineers of shipbuilding and repairing companies.

1. If water for drinking and culinary purposes is to be taken by the vessel en route from overboard, it will be necessary that a system of purification be provided, which is satisfactory to the United States Public Health Service. Your attention is invited to page 25, Interstate Quarantine Regulations of the United States, relating to this matter.

2. The storage of water on the vessel for drinking and culinary purposes, either when purified aboard or taken from approved supplies ashore, shall be in tanks of adequate capacity for the needs of the passengers and crew; all tanks shall be of such design that they can be readily and completely drained and flushed, and that the water contained therein will be kept free from exposure to contamination. All possible points where leakage may occur shall be eliminated or designed so as to reasonably minimize the possibility of leakage. The covers of all openings into the tanks shall be watertight.

3. The filling arrangement to such tanks should be so installed as to make it unnecessary that large manholes and other openings be kept uncovered. A small filling pipe provided with a cap should be provided for the purpose of filling the tanks.

4. There shall be no physical connection whatever between the drinking water tanks, pipes, pumps or any part of the system and any other water system on the vessel, or to the sea-cock, bilge pump, fire pump or boiler feed supply (if other than the drinking water is ever used for this latter purpose).

5. The use of storage tanks, containing drinking or culinary water, built in the fore and aft parts of a vessel by placing a bulkhead across the ship and allowing the hull to form part of the tank is strongly discouraged, because such tanks are difficult of access and in case of leakage are subject to potential contamination.

6. In no case shall soil pipes from water closets or drainage pipes of any kind pass through storage tanks containing water for drinking and culinary purposes.

7. There should be no water connections in the kitchens whereby it may be possible to draw water from any but the drinking and culinary water supply.

8. All spigots, faucets or connections whereby it is conveniently available to draw water from other than the regular drinking water supply on board the vessel shall be posted with permanent signs warning that the water is not safe for drinking.

9. Arrangements should be made for the cooling of drinking water on the vessel so that there can be no contact between the water and the cooling ice. This can be most conveniently accomplished by the use of coils in the ice chest.

10. The use of lead pipe in connection with the drinking water system on board the vessel is prohibited.

A. W. MELLON, *Secretary.*

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Packing and Gaskets for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

ON account of the variety of materials and combinations of materials that are made up into packings and gaskets of various kinds and also because of the fact that in most cases packings and gaskets are selected as a result of their past performance rather than on account of the materials of which they are made, the principal value of any article on this subject is the presentation of certain fundamental rules governing the selection of such products.

For past performance, which is so important a factor, the shipbuilder, operator or designer has resort to a number of channels of test and experience in addition to his own accumulated knowledge. One of the most valuable of these is the United States Navy Department, which has lists of approved packings for all of the most important uses. These are subject to change from time to time as new products are tested out and found to be up to standard requirements.

Packings and gaskets are one and the same thing from the point of view of the materials of which they are made and the purpose for which they are used. As purchased, they are all packing except when ordered made up to size and shape for making tight joints between stationary parts, in which case they are called gaskets. As used, the strips or forms of material, cut from sheet packing or otherwise, are called gaskets, except when inserted in stuffing boxes and similar packing spaces in way of moving parts, in which case they are called packing. There are metallic, semi-metallic and "soft" or fabric packings and gaskets and their nature and use can be best shown by dealing with them under the headings of Packing of Moving Parts, Packing of Stationary Parts, Boiler Gaskets and Miscellaneous Packings.

Packing of Moving Parts—Packings

Assembled Metallic Packing

An assembled packing consisting of a container which fits into or against the stuffing box, metal wearing rings, springs to keep the rings against the rod and any other necessary parts, is usually designated merely as metallic packing and is assumed to be required where "metallic packing" is specified on shipboard. Such a packing is the standard for high pressure piston rods and valve rods of reciprocating steam engines. On account of its flexibility it is especially desirable where there is a lack of alinement throughout the length of the stroke. The packing rings are of cast iron or bearing metal, or a combination of both. When properly cared for, the rods are not subject to as much friction and wear as with the so-called soft packings, and the metallic packing is less expensive in the long run.

This packing is particularly desirable for the main engines, the steam end piston rod of main and auxiliary boiler feed pumps, and the piston rod of circulating pump and independent air pump engines. Representative packings of this kind are the Cook, France, Holmes, Katzenstein, Martel, Mitchell, United States and Watson packings.

The writer knows of no assembled metallic packing that will hold water or ammonia without the use of a ring or two of soft packing.

Metallic Packing, Miscellaneous

There are various metallic packings on the market which consist of rings of bearing metal of various shapes and cut in various ways so as to break the joints. They are cheap substitutes for the assembled metallic packing and are of no value for severe duty. They are of value in some cases on small rods and have less friction and cause less wear on the rods than some of the soft packings. They generally require one or more rings of soft packing to make a tight joint and such combinations are proposed for certain services by their manufacturers.

Semi-Metallic Packing

Such packings are usually of bearing metal or lead braided, shredded or in the form of shot. In some cases graphite is mixed with the metal, and in other cases the lead and graphite are made plastic by the addition of bismuth. From their nature they might be called metallic packing, but it is safer to class them as semi-metallic.

They are generally found to be unsatisfactory when used for either rods or slip joints. They melt into a hard, solid mass, frequently leak and are difficult to remove when it becomes necessary to renew them or replace them with some other form of packing.

These packings require one or more rings of soft packing when used to hold water, air or ammonia.

Some of the manufacturers of soft packings produce products which contain bearing metal in combination with other materials, and this is another type of semi-metallic packing. They also produce a braided soft copper wire packing, to be used in combination with fibrous packings for high pressure work.

Soft Packing

Non-metallic packings for the service now under consideration are called soft packing. Their name is legion and their composition and construction very diverse. There are however certain fundamental considerations from a materials point of view which are of value in making a proper selection for any particular service. The packing should be resilient and flexible and retain these qualities under the service conditions, and it should not be of a construction that will allow pieces of it to get loose and work away. Asbestos is the premier material for high heat and is a valuable packing material generally; but it is deficient in elasticity. Rubber gives resiliency but dry heat and oil destroy it. Hemp is too coarse. Cotton is soft and elastic but will not stand heat. Flax is very flexible, but expensive, and will not stand heat.

The most satisfactory soft packings for severe high heat steam service or air service consist of combinations of carefully treated long fiber asbestos which is lubricated with graphite and various compounds, with a rubber cushion that is usually near the back of the packing. Some of these packings which have been found to give good service on shipboard are:

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Anchor Packing Company.....Ankorite Superheat No. 205
Belmont Packing & Rubber Company.....Belmont No. 50
Consolidated Packing & Supply Company..Consolidated No. 306
Crandall Packing Company .....Helios No. 303
Garlock Packing Company .....Garlock No. 150
H. W. Johns-Manville Company .....Kearsarge No. 165

For medium or low pressure steam service the cotton duck and rubber packings are satisfactory.

For packing around the stems of valves and similar service braided or twisted asbestos rope packings are satisfactory, but such packings have only a short life around high pressure rods or in steam line slip joints.

Ammonia rods require a specially expansive and resilient packing and in some cases pure rubber rings are used in combination with other packings. For expander and compressor rods some lubricated combinations of rubber and duck have been found satisfactory, such as

Belmont Packing & Rubber Company.....Belmont No. 103
Goodyear Tire & Rubber Company.....Lubricated Ammonia

This kind of packing will give trouble in case of overheating.

For gas, gasoline and oil, braided asbestos lubricated packings are suitable. Woven flax packings are also satisfactory for cold oil. For inside packed oil pistons the special hydraulic packing referred to under the head of water packings is used.

For cold water and brine service such as pump plungers and rods, stern tube and pipe line stuffing boxes, etc., flax packings are the best. Tucks packing, which is the name for a cotton duck and rubber combination made by a number of the manufacturers, is also good for pump plungers and rods. Alternate rings of square flax and round Tucks packing have been found to give long service in feed pump plungers.

For hot water service the duck and rubber packings as used for medium and low pressure steam are suitable.

Inside packed pistons call for a specially hard durable packing that will not swell from absorption of water, and for this service a packing made of layers of closely woven duck held together with a fine grade of white rubber has been found most suitable. It goes by the name of "hydraulic packing."

For centrifugal pump stuffing boxes and other revolving shaft work, a braided asbestos lubricated packing such as "Palmetto" made by Greene, Tweed & Company has been found to give very good results.

Cotton lamp wicking is of value for cold water service around valve stems.

Packing of Stationary Parts—Gaskets

Gaskets cut from sheet packing are required mainly for cylinder covers and in pipe lines and valve bonnets. They generally range from 1/32 inch to 1/16 inch thick. For steam up to 125 pounds pressure and for water of all pressures 1/32 inch will usually suffice. For steam from 125 to 250 pounds and for oil 1/16 inch is a good thickness. In some cases such as fuel oil suction and oil filling lines gaskets for oil tight work are made 1/8 inch thick of compressed cardboard. Good practice for the gaskets between component parts of pumps, condensers and feed water heaters is to specify a thickness of not less than 1/32 inch nor more than 1/16 inch, and for evaporators and distillers, a thickness of not less than 1/16 inch nor more than 1/8 inch.

METALLIC

The metallic gaskets most frequently met with on shipboard are the sheet lead gaskets used about the refrigerating plant installation. Soft copper or lead wire rings are required between the stuffing box and the gland with certain types of assembled metallic packing. The copper is preferable

COMPRESSED ASBESTOS FIBER

Gaskets of this material are the best for all high heat service including cylinder head joints of steam and internal combustion engines. The asbestos fiber is compressed under great pressure with bonding materials. In some cases one side of the packing is graphited or otherwise treated so that it will not adhere to the joint surface, and the other treated so that it will adhere, thus preventing destruction of the gasket when the joint is taken apart. This results in the two sides being of different colors.

Examples of these sheet packings, or gasket materials, which have given good satisfaction on shipboard are:

Anchor Packing Company.....Ankorite No. 425 and Tauril
Consolidated Packing & Supply Company.....Consolco No. 500
Crandall Packing Company.....Rex Style No. 1920
Durabla Manufacturing Company.....Durabla
Garlock Packing Company .....No. 900
Goodrich Company .....Special Black
Goodyear Tire & Rubber Company.....Goodyearite
H. W. Johns-Manville Company.....Service Sheet
Johns-Pratt Company .....“Red Fibre”
New York Belting & Packing Company.....Firo

WOVEN ASBESTOS CLOTH

This packing is an asbestos fabric with fine brass wire interwoven and impregnated with a special compound. It is an expensive high heat sheet packing that is not as efficient as the compressed asbestos fiber packing. It is necessary where the joint surfaces are rough and uneven. It is particularly suitable for such service as exhaust pipe header flanges. The Johns-Manville Company's “Mobilene” is an example of this kind of packing.

RUBBER

Rubber is the ideal gasket material for watertight work about the hull, in watertight doors, manholes, etc., and for washers generally. It cannot, however, be used where oil or gasoline might come in contact with it; so is not suitable for manholes of double bottoms that may carry oil and similar service.

Pure rubber rings are also the approved gaskets between the tail shaft liner and the propeller hub to keep water out of the propeller cavity.

Rubber gaskets are also used in ammonia joint work.

RUBBER COMPOSITIONS

These are of particular value where the leakage of water or brine is to be prevented. They can be obtained plain or with cloth or wire insertion, which add to the life and strength of the packing. Like pure rubber, such packings will not in general stand exposure to heat, oil or gasoline.

The cloth insertion packing is usually furnished in two grades. Grade No. 1 is expensive and is intended for use only in joints which may be expected to last for years. Grade No. 2 is a high-grade packing costing about one-third as much as Grade No. 1 and should be used for all ordinary purposes.

The wire insertion packing should be limited to hot water and low pressure steam joints. High pressure steam gradually burns it out. It is very expensive and in most cases some other type of packing should be used. It is customary on hot water pumps to have the same kind of gaskets on both the steam and water ends.

Examples of rubber composition packing, which have been found satisfactory are:

U. S. Rubber Company .....“Rainbow”
B. F. Goodrich Company .....“Akron Red Sheet”

Some packings of this character soon crack and deteriorate in a store room.

WOOD FIBER

Wood fiber sheet packings are made to resist oil, gasoline and water. They contain no rubber or rubber substitutes

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that are soluble in oil or gasoline. Tough oiled paper is an example of thin packing of this kind. Cardboard cut to shape without joint and soaked in a mixture of 10 parts varnish and 20 parts wax makes good gaskets for oil tank manholes. Proprietary packings that have given good service on shipboard are:

Endura Manufacturing Company	Endura
Fibre Finishing Company	Vellumoid
Garlock Packing Company	Garlock No. 680
H. W. Johns-Manville Company	Seigelite

Boiler Gaskets

Boiler gaskets for manholes and handholes or for the tube caps, tube plates and headers of watertube boilers are ordered of the desired thickness made up from templates and are only made from sheet packing or gasket tape in case of emergency. The material is usually the best long fiber woven asbestos cloth, with bronze or brass wire insertion, the layers of cloth being firmly held together by a high grade cement or binder. They should not be loaded with a lot of white lead or other filler. Some special combinations of metal and asbestos have been found satisfactory.

An emergency gasket may be cut from woven asbestos cloth brass wire insertion sheet, but it will not last long and should not be used where exposed to water.

Old boilers cannot use rigid type gaskets and may require thicker gaskets than new boilers.

Gaskets for handholes should be made without joints. Manhole gaskets may have joints covered with tape.

The following list names some of the gaskets which have been found to give good service:

	Handhole	*Manhole*
Asbestos Textile Company		Navy
Belmont Packing & Rubber Company	Belmont High-Pressure	Belmont High-Pressure
Philip Carey Company		No. 751
Crandall Packing Company	Helios	Helios
Danubil Company	Hudsonil	
Durabla Manufacturing Company	Durabla	
Flexitallic Gasket Company		Flexitallic
Johns-Manville Company	Kearsarge (seamless)	Kearsarge (best)
Keasbey & Mattison Company	Battleship	Battleship
Vulcan Asbestos Mfg. Company	Vulcan	Vulcan

Miscellaneous Packings

Canvas

No. 6 canvas painted with red lead on the condenser side and with graphite on the cover side makes a good jointing for main and auxiliary condenser head covers.

Corset Lacing

This is the approved packing for making tight joints around the ends of condenser tubes.

Tar Felt

This is used between sea chest flanges and the shell plating, and similar service. The material is described in the article on "Calking Materials."

Cup Leather

Cup leather packings are sometimes required for the reversing engine and other special service, and are obtainable from the packing manufacturers.

Paste Jointings

Red lead, white lead and other substances in paste form are sometimes used to make tight joints, either alone or when mixed into fibrous materials.

One of the best of these paste jointings is an imported proprietary substance called manganesite. It has been found very satisfactory for turbine casing joints. This material with wire gauze is used between the flanges of boiler mountings and the boiler shell.

The following is a good list of engineer's consumable stores of packing for one ship:

Steam Packing—Quantity

High pressure steam packing, square, spiral, for Main engine piston and valve rods, sizes as needed	2 sets of each
High pressure steam packing, square, spiral, for Piston rods for pumps and deck machinery, ⅜, ½, ⅝, ¾ inch and above, if required	1 box of each
Valve stem packing, asbestos, braided, ⅛, ¼, ⅜, ½ inch	1 box of each
Asbestos tape, 1½ by ⅛ inch	10 pounds
Asbestos tape, 1 by ⅛ inch	10 pounds

Water Packing

Flax or Tuck's, square, for pump rods and plungers, ⅜, ½, ⅝, ¾ inch and above, if needed	1 box of each
Stern tube gland, size as needed	1 box
Cotton lamp wicking, for cold water, in 100 yard balls	5 balls
Corset lacing, for condenser tubes, in 100 yard balls	2 balls

Sheet Packing (Standard Size Sheets)—Quantity

Asbestos fiber compressed, high pressure steam joints, 1-16 inch thick, for—	
Reciprocating engines	10 square yards
Turbines	5 square yards
Compressed wood fiber, for oil joints, 1-32 inch thick	5 square yards
Rubber, wire insertion, for hot water or exhaust steam, 3-32 inch	5 square yards
Rubber, cloth insertion, cold water, 1-16 inch	10 square yards

Special Packing and Gaskets

Asbestos or cup leather, for reversing engine cylinder, as needed	2 sets
Ice machine compressor's rods, as needed	2 sets
Rope, asbestos, twisted, for boxheaders, watertube boilers, ⅜ inch, if needed	1 ball
Gaskets, manhole, boilers, as needed	1 dozen
Gaskets, handhole, for watertube boilers, as needed	100 percent
Manganesite, for turbine joints	10 pounds

Tests of New Pumping Equipment on New York City Fire Boat "James Duane"

TESTS lasting six hours were recently run on the new pumping equipment of the New York city fire boat *James Duane* at the Clinton plant of the Todd Shipyards Corporation.

The tests were under the supervision of the fire commissioner Thomas Drennan and other officials from the fire department and the National Board of Underwriters. The results indicate that the boat will be one of the most efficient fire fighters afloat, having a discharge capacity of 9,800 gallons per minute against a nozzle pressure of 150 pounds.

The new pumps are of the Lea-Courtney centrifugal, single stage, double suction type driven by Westinghouse steam turbines. The tests included the pumping capacity against 175 pounds' nozzle pressure, at which pressure the pumps delivered 7,900 gallons per minute; against a pressure of 300 pounds the capacity was 4,850 gallons per minute. The guarantee called for 9,000 gallons of water against a nozzle pressure of 150 pounds; 7,500 gallons against a pressure of 175 pounds and 3,000 gallons of water against a nozzle pressure of 300 pounds; all of which requirements were exceeded in the trials. In case of necessity in flooding the hold of a ship, the pumps will be able to deliver about 12,000 gallons of water per minute against a nozzle pressure of 90 pounds.

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Special Requirements in Design of Marine Machinery

Reliability—Weight and Space—Accessibility—Resistance to Corrosion—Stresses Induced by Movement of Vessel and Vibration—Spare Parts

By Lieutenant Commander C. S. Gillette, U. S. N.*

IT is a matter of common observation that many designs of mechanical and electrical equipment, based on ideas fundamentally sound, and proven by practical experience in shore establishments, fail deplorably when an attempt is made to adapt them to marine installations. It appears certain that a large percentage of such failures could be avoided, if due consideration were given to the special requirements of marine and naval service and an effort made to modify the design to meet such requirements before the marine market is approached.

Of course great merit in any new design will eventually win out and after a sometimes long and painful process of evolution the equipment will finally arrive at a stage of complete suitability for marine or naval use. But the process of evolution could be much shortened and time and money saved by both user and producer, if even a partial realization of the conditions to be met were possible before the original trial on board a vessel.

Why Marine Practice is Conservative

Marine practice is always conservative and it has good reason to be. Naval practice is perhaps somewhat less so because of the need of being strictly up to date in all that pertains to fighting efficiency so that experimentation is more readily accepted. Fighting efficiency is and must always be the primary consideration of the Navy and first cost and operating expense the secondary, except where the latter may directly or indirectly affect the former.

Conservatism in marine practice is more than mere caution induced by past experience with careless designs. No matter how excellent the design of mechanical or electrical equipment may be it is absolutely dependent on the ability of the personnel available for operation and upkeep. The training of personnel on new equipment is an expensive process, and nowhere more so than in the marine and naval service, where efficient personnel is the product of long experience and the number available very limited. Strong prejudice always exists to a more or less extent among such personnel, against innovations, and unless a design has been well thought out originally and the special marine requirements given weight it will be in danger of quick condemnation on the first minor indication of deficiency even though basically the idea may be sound. Particularly is this true of the many small items of auxiliary equipment and apparatus designed to give increased economy, convenience, safety or add in some other way to operating efficiency.

The Case of the Scotch Boiler

As an example of this conservatism the old cylindrical Scotch type boiler still remains the standard in the commercial marine service despite the many attempts to displace it. It has of course certain fundamental characteristics which make it especially valuable for this service such as the large amount of water contained, the volume of the steam space and the relatively smaller amount of attention required in operation and upkeep. But its long record of satisfactory operation and the complete familiarity of the personnel with all the details of the design have much to do with its permanence as a standard in this field. It holds its own in spite of the passing of its companion the reciprocating engine although even the latter has held on longer than was justified by its many un-economical features. This latter was reliable and the personnel were familiar with it which fact, added to the reliability of the design, has made it a favorite until the keenness of competition in ocean freight rates gradually is forcing it out.

It is at once obvious that marine and naval requirements cannot be exactly specified in an absolute sense. However, it seems that it would be of some value to point out certain of the most outstanding features of this service as it differs from conditions on shore.

Manufacturers Too Often Unfamiliar With Seagoing Conditions

The seagoing man often takes for granted a knowledge of conditions existing at sea among landsmen which to the former scarcely seem worth mentioning because they are so obvious. Among manufacturers in general, however, who have not had an opportunity to see for themselves at first hand just what these conditions are it is not believed that they are quite so obvious. Certainly, if their products may be considered as evidence of such knowledge, it is apparent that it is often decidedly lacking or dependence is placed on the failure of marine and naval purchasing agents to discover the defects. The failure of purchasing agents to reject, however, does not prevent a mechanism from failing in service and this soon reacts seriously on the manufacturer and may mean his being more or less completely cut off from the marine or naval market. Among sea going engineers news of failures of material travels swiftly and aided sometimes by competitors' agents it reaches the ears of those far removed from the scene of the original failure and the manufacturer may find himself shut off from supplying materials of entirely different nature than those on which failure occurred and which might be entirely suitable.

It will be understood of course that all the desirable characteristics as to economy, etc., included in a design for land installations are equally important at sea. In addition thereto certain of these must be of a higher standard for sea service and a few included which land service does not require. However, it has been the experience of at least a few manufacturers that, in developing their product to meet marine demands, the same development was quite advantageous and equally applicable in improving their products for land service.

Special Requirements of Commercial Marine Service

The special requirements of commercial marine service are about as follows:

a—Maximum reliability.

b—Minimum space and weight factors.

c—Maximum accessibility for inspection, cleanliness and repair.

d—Maximum resistance to corrosion.

e—Satisfactory operation on a moving platform and in planes inclined to the horizontal from 15 to 20 degrees with special attention to lubrication under these conditions which occur on a ship in service.

f—Ability to withstand large and uneven stresses induced by the laboring of a vessel in a heavy sea way and the variable propeller load.

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g—Satisfactory operation under vibrations of the mounting at fairly high frequencies.

h—Adequate spare parts but no more than is actually necessary, exactly fitted to their place and arranged for easy installation and stowage.

j—Suitable marking of all equipment and parts for ease of identification and accurate requisitioning from distant parts of the world.

The special requirements for the naval service include all of the above with a somewhat higher standard of performance especially in regard to the first four. In addition it demands the following characteristic:

a—Satisfactory and continuous performance under heavy shock, as that induced by the discharge of the vessel's own guns of fairly well known and constant amount, or by the striking of enemy's shells and explosion of mines or torpedoes at almost any point of the ship's structure and of more or less unknown amount. The design must always take into account the maximum possible effect.

Another point of difference between the marine and naval services is that the latter usually is supplied with sufficient personnel for inspection, upkeep and repair—a personnel better organized and under better control. Thus material on naval vessels receives more attention and care and can be kept in better condition than that of the merchant marine. However, on a naval vessel there is a much greater quantity of apparatus and equipment of a more delicate nature so that in spite of the additional personnel available the design must take into account and consider all of the factors set forth.

Reliability

Taking up individually the above enumerated requirements for discussion it appears that reliability is the most important and essential of all. Many of the others that follow in the enumeration more or less directly affect this fundamental characteristic. Reliability of course is important in land practice but to a relatively much less degree. Failure in a land plant rarely causes more than inconvenience and some financial loss. Nearly always spare machines are available or an auxiliary power source can be utilized with little difficulty. Further, unlimited technical assistance and repair facilities are quite usually at hand or can be quickly obtained. First cost only limits the number of spares that can be kept on hand and often nothing of consequence is strictly essential because of the proximity to the source of supply.

In contrast to this consider the position of a vessel at sea when break down occurs. If it takes place in stress of weather, as is often the case, the conditions are infinitely worse. Anyone who has ever attempted important repairs on a ship which is rolling and pitching violently in a heavy seaway will not be very approachable on the subject of the purchase for a vessel of an apparatus whose reliability is not absolutely proven. At such a time too the name of a manufacturer who has thoughtfully anticipated such conditions and planned for ready lifting and handling and easy installation of spares will be blessed. Particularly is this true when spares fit properly without the slightest alteration.

Repairs at Sea

The number of spares that can be carried is very limited. A vessel is built to carry cargo—not a multitude of spares—and in the case of a naval vessel to make high speed for fighting and all unnecessary weight must be cut down. To make the necessary repairs a vessel can draw only upon her own resources and the ship's engineers must furnish all the technical assistance that is needed. The lives of the crew and passengers and the value of the ship and cargo may be and often are dependent upon their unaided skill. The facilities available are never more than a meager supply of machine and hand tools, the knowledge of the ship's engineers and the skill of their own hands.

As a rule there is always sufficient floor space available in land installations or it can easily be obtained, while weight is seldom if ever an installation factor, other than a problem of handling. On ship board, however, there is never entirely adequate space. In order not to defeat the object for which the ship is built it becomes one of the greatest problems of marine construction to arrange her necessary equipment in the smallest possible space, consistent with safe operation. The same is true of weight. The capacity and floatability of a vessel are the factors which justify her existence as a ship and anything that detracts from either the one or the other reduces in the same proportion her value for the purpose for which she was constructed.

Accessibility

Considering the necessarily restricted space it is at once obvious why special attention must be given to accessibility. When cleaning and repairs must be executed in an extremely confined space, a design with conveniently accessible units will necessarily be considered the most successful. The troubles of the operating engineer at sea are sufficiently great under the handicap of confined working space without adding to them by the installation of a poorly thought out assembly which would be difficult to take care of even under normal conditions of illumination, floor space and handling facilities. The personnel on board ship usually does its work in cramped locations, with poor lighting and high temperature conditions and on an often violently moving platform. Careful thought must be given to any heavy weights that must be handled and facilities provided for taking care of them under rolling and pitching conditions on a vessel. To lose control of a heavy weight under the latter condition endangers life and limb and even possibly the ship itself. Easy inspection is also essential in order to promote reliability. Any apparatus, the careful inspection of which is difficult, will naturally receive less attention and break downs of serious nature, which might be prevented by timely steps to repair worn parts, will occur.

Corrosion

Sea air is highly corrosive and parts not properly protected or of easily corrodible material will disintegrate with the greatest rapidity, far exceeding that of any ordinary land practice. Even in fittings designed to be strictly watertight, the structure "breathes" during changes of temperature and air saturated with moisture will enter and corrodible materails will be quickly attacked. Increase of temperature forces air out and a drop will draw air in. A further drop will precipitate moisture from the saturated sea air and corrosion commences. Below decks there is leakage from pipes and condensation of vapor of steam and oil added to sea air from the ventilating blowers and usually high temperature—in general, about the best conditions to promote active corrosion possible to obtain. To this may be added the ever present danger of galvanic action between the many dissimilar metals of a ship's structure and water with varying degrees of acidity or alkalinity. It is not possible for a design to go too far in an effort to resist corrosion. It is the ever present foe of steel ships and their fittings and the landsman designing for marine installations must appreciate the danger to the full or his design must inevitably fail.

Marine machinery operates on a moving platform. Any apparatus that employs the force of gravity to function properly will be at a serious disadvantage in the marine field even if it would work at all, as this force will be received through constantly changing angles. One of the most common difficulties experienced is interference with the lubrication through the changing of the amount of the bearing pressures and the introduction of stresses and strains through the working of the flexible ship's structure which forces change of alinement of bearings and varies the bearing clearances.

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FLEXIBILITY OF SHIP'S STRUCTURE AND VIBRATION

Further, due to this flexibility of the ship's structure, stresses are uneven and the design must have a rigidity and strength to withstand them, entirely uncalled for in land practice. The laboring of a ship in a sea way, the variable propeller load and differences in the loading all contribute toward making even the lightest duty relatively difficult under such varying conditions. The tunnel bearings of the propeller line shafting of a vessel give a good illustration of this as the temperature of these bearings is constantly changing as the loading or the weather conditions change. A bearing running cold today will be hot and require constant attention the following day if the loading is changed or the weather conditions vary.

Vibrations are more or less a source of difficulty. However, in this respect conditions on land are often nearly as bad. In every part of the ship's structure, however, they are present. With modern vessels they are less a problem. They affect instruments mainly and the more delicate of the ship's equipment and in such classes of apparatus they must always be considered.

SPARE PARTS

The question of spare parts has been discussed under the requirement of reliability. The number must be limited not only because of cost but because of lack of stowage space. Those that are furnished must be accurately fitted, arranged for stowage, handling and ease of installation. A modern naval vessel particularly is a veritable maze of intricate machinery for each item of which more or less spare parts must be carried. Convenient stowage is difficult and parts must be properly protected and arranged for easy identification, particularly for naval vessels. Interchangeability is a great advantage not only for parts carried but for parts that may be ordered in distant parts of the world. Proper arrangements for identification of parts in ordering must be arranged for in order to avoid confusion and delay when the need may be urgent and the factory distant.

The Navy, as previously stated, adds to the above the requirement that the apparatus shall be proof against shock. It is readily appreciated that, in a naval engagement, shock of discharge of a vessel's own guns and the impact of the enemy's shells, torpedoes and mines on the vessel's structure may seriously derange vital mechanisms even though no direct hit on the mechanism itself were made. The effect of discharge of a vessel's own guns is a measurable quantity, but the effect of the striking of enemy' shells, etc., is a very uncertain affair. However, these things must be always taken into account in a design and allowed for in the mounting and in the relations of the various parts to each other. Such equipment as circuit breakers, for example, form a good illustration of equipment easily deranged by shock. It would appear at first thought that this demand could not always be satisfactorily met but it must be met, if a naval vessel is to fulfill its mission as an efficient fighting unit, and experience has shown that by careful consideration much can be accomplished as in the case of the illustration given above, viz. naval circuit breakers.

Much more could be said along these same lines but it is hoped that enough has been given to bring out some of the most important of the difficulties to be overcome in successful marine design as opposed to land practice.

Chamber of Shipping Gives Rules to Prevent Pilferage

Claims Twenty Times as Large as Before War Have Been Paid for Pilferage by Shipowners Since Armistice

THE Council of the British Chamber of Shipping appointed a committee in 1920 to study the subject of pilferage and to prepare a set of recommendations for the prevention of theft which has increased to an alarming extent since the war. This committee has formulated rules which it is hoped will be found applicable to the ports of all nations, and particularly to those ports where shipowners are suffering from excessive claims on cargo.

Three reasons are given for the increase of the pilferage evil, namely: (1) The general increase in values which augmented the pre-war claims about threefold. (2) Chaotic conditions occasioned by the war, especially interference in and control of trading facilities by Government departments and the congestion resulting from a trade boom immediately succeeding the war. (3) By far the most important factor, however, was the increase in the general debasement of the standard of common honesty which was a legacy of the war.

While the following rules are necessarily general in character in order that they may cover all ports and while some ports have organizations which are effective in the prevention of pilferage, it is recommended that the rules be accepted by shipowners, particularly where pilferage is common.

1. TALLIES AND WATCHING

"Tallies should be taken both in and out of ship. It is specially important that this should be done when discharging on to open quays, or into lighters, or on to the quays of docks and warehouses not under control of the shipowner.

"The absence of tallies should be permissible only when the quay is absolutely under the sole control of the shipowner; but even where shipping companies use their own wharves the Committee consider it is desirable that these tallies should be taken in order to locate the individual responsibility of each man handling the goods. Without such precaution it is impossible to investigate satisfactorily each stage in the process of discharge and loading and thus fix the exact spot where the error, loss or damage arose.

"Generally, the Committee desire to emphasize that it is impossible for officers to perform their duties adequately unless a legible and clear tally of the cargo is received at the port of shipment More care is required on the part of all tally clerks to ensure that their tallies, including carbon copies, are complete and distinct. If these particulars are not accurate and distinct, it leads to much confusion on discharge and in such cases the officers who supervise the disharging are seriously hampered in their duties.

2. OFFICERS

"An officer or his representative should be appointed to each hold.

"Where sufficient officers are not available to supervise at each hold, substitutes should be appointed from among the petty officers, apprentices, wireless operators and other reliable members of the crew.

"Wireless operators and watchers should be regularly employed in addition to officers in connection with the work of supervising the tallying and watching of cargo, and it is desirable that steps should now be taken to constitute them part of the ship's personnel for performing cargo duties in port, under the orders of the master. This is a reform which will yield the wireless operators some much-needed occupation in port, and the deck officers some relief at busy times.

3. ALPHABETICAL TALLY BOOKS

"The Committee recommend the extended use of the aphabetical system (with which most shipowning organizations are familiar) by those tallying on behalf of ship, which prevents collusion with those using continuous sheets tallying against the ship. If the tally into the ship is not taken alphabetically, the continuous sheets should show the number of the hatch into which cargo is being worked. The officers during the voyage should prepare from these

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leading sheets a separate alphabetical tally book for the cargo for each port of destination in each hatch and, in addition, a second set of such alphabetical books may be prepared for use by ship's tally clerks in discharging. This will be found most advantageous. This second set should show the marks only, and the numbers should be added by the ship's tally clerk in discharging. On ceasing work each day these tally clerks should hand their books or tally sheets to the officers to check them off with their own complete tally books and thereby be able to follow closely the accurate outturn and take prompt steps to trace any deficiencies and to have 'bad order' goods assessed for damage by ship's surveyor before leaving port. The books with marks prepared save many errors through speed of discharge leading to inaccurate record of marks.

4. Precautionary Measures on Board Ship

"(A) There should be only one entrance to cargo holds, viz., down the hatchway.

"(B) All ventilators should be protected in order to prevent access to holds through them.

"(C) All hatches should be fitted with bars and locks capable of being quickly and easily manipulated and kept closed and locked during the passage between coastal ports.

"(D) In insulated steamers when holds are loaded with general cargo the doors leading from the engine room, &c., to the air trunks and holds should be locked and the key kept always by a responsible cargo officer.

"(E) During meal hours, the deck should never be left without an officer in charge, and when contractors are working in the holds during the stevedores' meal hours a special watchman should be stationed in the hold to watch these men.

5. Pilferage at Sea

"If, during the course of a voyage, tampering with the cargo or pilferage thereof has been discovered by the officers, the Commitee recommend the master of the ship to communicate with the agents by wireless requesting them to send detectives on board the ship before the vessel is moored alongside the quay; so that a proper search may be instituted and the thieves discovered and prosecuted.

6. Dock and Harbor Authorities and Ships' Passes

"Where goods are tallied by the ship within sight of the ship's rail, dock and harbor authorities receiving the cargo should always give receipts for same.

"The authorities should be more strict in the scrutiny of persons allowed to enter and leave dock and harbor premises.

"A system of triplicate passes should be adopted in all ports for any goods taken out of docks under the ship's pass (called 'Goods Passes'), one to be retained in the pass book of ship, and two to be handed to the person in charge of the goods, both of which should be given up at the dock gates. The dock authority should retain one of these two for their purposes and send the other to the ship's agent. Where this procedure has been adopted it has been of great benefit.

"There should be stricter examination of conveyances by road and water (carts, lighters, &c.) by those who are charged with this duty.

"The Committee recommend that port authorities should accept full responsibility for all cargo not removed from transit sheds within seventy-two hours from final landing of the goods. The Committee consider similar conditions should even apply at ports of the world where the legal limit of seventy-two hours is not imposed, particularly where, as is frequently the case, the port authority is the constituted agent of the consignee for taking delivery. This practice should be recognized in cases where steamship owners rent a quay with sheds for the discharge of their steamers' cargoes. It is obvious where sheds are rented merely as transit sheds the receiving authority should be responsible for the safe-keeping of the goods in such sheds, after the usual seventy-two hours.

7. Damaged Packages

"When, during the discharge, packages are discovered which have been tampered with, or damaged in any way, the Committee recommend the following system should be adopted:

"(1) Such packages should be retained on board the ship under the officers' supervision until they can be discharged and their condition certified, or

"(2) Immediately on landing placed in a special cage, lock-up or other safe depository.

"(3) As a precautionary measure such packages should immediately be weighed and the ascertained weight indelibly marked on the package; they should also be securely fastened.

"(4) Goods of this description should be thoroughly examined and the condition of them agreed with the officers before the ship leaves the port.

"Customs authorities should be urged to support officers and agents in this procedure.

8. Pilferage Reports to Owners

"Shipowners should bring claims at all ports under the scrutiny of a well-equipped department at head office. The results are calculated well to repay the expenditure. Reports should be sent direct to such claims department promptly at the time when the pilferage is discovered, and should show specifically which claims arise from pilferage. These reports should contain precise particulars to enable the department to trace the goods in question.

9. Legal and Magisterial Action

"Shipowners should prosecute every detected case of pilferage. There is a certain reluctance to institute legal proceedings, but such proceedings are imperative if pilferage is to be stopped.

"Magistrates should be urged to impose imprisonment on persons convicted of pilfering. Fines are generally inadequate and moreover are usually paid by the delinquents' mates or associates.

"The magistrates' powers of dealing with persons convicted of unlawful possession should be enlarged and the maximum fine in this country should be increased from £5 to £20.

10. Bills of Lading, Mate's Receipts and Indemnities

"The Committee strongly deprecate the custom of issuing Bills of Lading for goods 'Received for Shipment' except where the circumstances make no other form appropriate; such a system gives scope for pilferage. In no case should shipowners, however great the pressure from merchants, issue a 'Shipped' Bill of Lading until the goods are actually on board the steamer, as the difficulties of protecting the steamer against claims for pilferage which may have happened before shipment are thereby greatly increased.

"Mate's receipts should not be claused indiscriminately with words used as 'more or less frail.' The actual condition of the goods should at all times be accurately noted in detail on the receipt and also on the Bill of Lading. Many shippers desire shipowners to accept indemnities in lieu of clausing Bills of Lading in accordance with the facts; this practice should be discouraged to the utmost. Courts of Law condemn the practice of giving such indemnities, by which bankers and other holders of Bills of Lading are undoubtedly misled.

11. Insufficient or Frail Packages

"Shipowners should reserve their right to reject goods appearing to be insufficiently packed and also their right to plead insufficiency of packing, at whatever part of the voyage it comes to light.

12. Special Goods, Specially Addressed Packages and Returned Packages

"These goods should always be carried in lock-ups securely fastened with two locks. The master should retain the key of one lock and the principal cargo officer the other. The cage or chamber should never be opened unless an officer is present.

13. Customs Examination

"Customs officials should mark with an official stamp or seal all cases and casks from which samples have been extracted.

14. Instructions to Masters and Officers

"The Committee suggest that shipowners should revise their standing instructions to masters and officers in reference to the care and handling of cargo with the object of bringing them up to date and giving this aspect of their officers' duty its due prominence.

"It has been said that the Committee's proposals are not likely to secure the active co-operation of the ship's officers. In reply to this evidence is forthcoming to show that officers are realizing their duties and are giving the most loyal assistance wherever the proposals are being adopted. In some cases further improvements in practice are suggested by the officers, which shows not only that the right lines are being recommended, but that the interest of officers has been aroused. The Committee suggest that Liner Cargo Superintendents should be requested to encourage the officers to take an interest in cargo as being the connecting link between the cargo departments at the respective ports.

15. Department of Overseas Trade

"Finally, the Committee desire to bring to the notice of shipowners this Department which is responsible to the Foreign Office and the Board of Trade for commercial matters in the hands of British Government representatives abroad. Each British Ambassador and Minister has on his staff a Commercial Secretary who is responsible for co-ordinating the work of the Consuls. Some of the Commercial Secretaries during their leave in this country have visited the Chamber of Shipping, and the Committee had the privilege of meeting them. They appear to have been excellently chosen for their combined knowledge of British commercial matters and the conditions of the country to which they are accredited. In the Committee's view, shipowners would be well advised to keep in touch with these gentlemen.

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British Regulations Against the Discharge of Oil Into Navigable Waters*

OIL in Navigable Waters Act, 1922. Chapter 39. An Act to make provision against the discharge or escape of oil into navigable waters. (4th August 1922).

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

PENALTY FOR DISCHARGE OF OIL IN NAVIGABLE WATERS

1.—(1) If any oil is discharged, or allowed to escape whether directly or indirectly, into any waters to which this Act applies from any vessel or from any place on land or from any apparatus used for the purpose of transferring oil from or to any vessel to or from any other vessel (whether a vessel to which this Act applies or not) or to or from any place, the owner or master of the vessel, from which the oil is discharged or allowed to escape, the occupier of the land, or the person having charge of the apparatus, as the case may be, shall be guilty of an offence and shall, in respect of each such offence, be liable on summary conviction to a fine not exceeding one hundred pounds:

Provided that it shall be a good defence to proceedings for an offence under this section to prove—

(a) if the proceedings are against the owner or master of a vessel, that the escape of the oil was due to, or that it was necessary to discharge the oil by reason of, the vessel being in collision or the happening to the vessel of some damage or accident, and also, if the proceedings are in respect of an escape of oil, that all reasonable means were taken by the master to prevent the escape; and

(b) if the proceedings are against any other person and are in respect of an escape of oil, that all reasonable means were taken by that person to prevent the escape.

(2) It shall be lawful for a harbour authority to appoint a place within their jurisdiction at which the ballast water of vessels in which a cargo of petroleum spirit has been carried may be discharged, and where a place is so appointed any such ballast water may, notwithstanding anything in this section, be discharged at that place, but only at such times and subject to such conditions as the harbour authority may from time to time determine:

Provided that the foregoing provision shall not apply to ballast water containing oil other than petroleum spirit.

For the purposes of this subsection, the expression "petroleum spirit" means refined petroleum which is subject to rapid evaporation and which, when tested in the manner prescribed by the Petroleum Act, 1879, or any enactment amending that Act, gives off an inflammable vapour at a temperature of less than 73 degrees of Fahrenheit's thermometer.

PROHIBITION OF TRANSFER OF OIL AT NIGHT

2.—(1) It shall not be lawful during the hours between sunset and sunrise to transfer any oil to or from any vessel lying in any harbour unless notice of intention so to do has been given in accordance with the provisions of this section.

(2) If any oil is transferred to or from any vessel in contravention of the provisions of this section, the master of the vessel and, if the oil is transferred from or to premises on land, the occupier of the premises shall, in respect of each offence, be liable on summary conviction to a fine not exceeding twenty pounds.

(3) A notice for the purpose of this section must be given to the harbour master of the harbour in which the vessel is lying and shall be of no effect unless given at least three hours and not more than ninety-six hours before the time at which the operation of transferring the oil commences:

Provided that, in the case of an operation to be performed at a place where such operations are frequently and regularly carried on, or in the case of a transfer of oil for fire brigade purposes, the notice may, instead of being a notice given to the harbour master within the time hereinbefore provided, be a general notice given to the harbour master to the effect that such operations will during such a period not exceeding twelve months from the date of notice, as may be specified therein, be carried on between sunset and sunrise.

KEEPING OF RECORDS WITH RESPECT TO TRANSFER OF OIL

3.—(1) There shall be kept in the case of every vessel a record, in such form as the Board of Trade may prescribe, of all operations in connection with the transfer of oil to and from the vessel.

(2) The record required to be kept under this section shall, in the case of a barge, be kept, so far as relates to the transfer of oil to the barge, by the person supplying the oil, and, so far as relates to the transfer of oil from the barge by the person to whom the oil is delivered, and shall, in every other case, be kept by the master of the vessel.

(3) Every record kept under this section may at all reasonable times be inspected by the harbour master of the harbour in which the vessel is or, in the case of a barge, was at the time of transfer or by any person duly authorised in that behalf by the Board of Trade, the Minister of Agriculture and Fisheries, the Fishery Board for Scotland, or the Ministry of Commerce for Northern Ireland.

(4) If any person required to keep a record under this section fails to keep such a record or to make proper entries therein, or to produce the record on a demand in that behalf made by any person authorised to inspect it, he shall, in respect of each offence, be liable on summary conviction to a fine not exceeding fifty pounds, and if any such person makes any entry in the record which is to his knowledge false or in any material particular misleading, or wilfully fails to make any entry in the record, he shall, in respect of each offence, be liable on summary conviction to a fine not exceeding one hundred pounds.

LIQUID CONTAINED IN SPACES USED FOR CARRIAGE

4.—(1) Where oil has been contained in any tanks or other spaces in a vessel, any liquid discharged or allowed to escape from those tanks or spaces shall, unless it is proved that the tanks or spaces have been cleaned of oil, or that the liquid has been freed from oil by means of a separating apparatus, be deemed to be oil within the meaning of this Act.

(2) In the case of proceedings against any person other than the master of a vessel, evidence of the matters aforesaid may be given by means of a certificate signed by the master, and, if the master of a vessel gives any certificate under this section which is to his knowledge false or in any material particular misleading, he shall, on summary conviction, be liable in respect of each offence to a fine not exceeding fifty pounds.

(3) In this section the expression "master of a vessel" means the person named as the master in the agreement with the crew.

*From the Transportation Division, Department of Commerce, Washington, D. C.

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APPLICATION OF FINES

5.—Where any person is convicted of the offence of having in contravention of the provisions of this Act discharged or allowed to escape any oil into any waters to which this Act applies, the court before which he is convicted may, on application of the prosecutor, order that the whole or any part of the fine imposed in respect of the offence shall be paid to such person as the court may direct for the purpose of being applied by him in or towards meeting any expenses incurred or to be incurred in the removal of the oil so discharged or allowed to escape.

POWER TO INSPECT PREMISES AND VESSELS

6.—(1) The Board of Trade may, if they think fit, either at their own instance or at the instance of the Minister of Agriculture and Fisheries, the Fishery Board for Scotland, or the Ministry of Commerce for Northern Ireland, or of any local authority, appoint any officer of the Board of Trade or any other competent and independent person to inspect any vessel being in any waters to which this Act applies, and any person so appointed or the harbour master of the harbour in which the vessel is may at all reasonable times enter upon the vessel and examine the measures adopted to prevent the escape of oil.

(2) If it is represented to the Board of Trade, by the Minister of Agriculture and Fisheries, the Fishery Board of Scotland, or the Ministry of Commerce for Northern Ireland, or by any local or harbour authority, that there is reason to suspect that oil is escaping or has escaped, whether directly or indirectly, into waters to which this Act applies from premises adjacent to or in the neighbourhood of those waters, the Board of Trade may, if they think fit, appoint any officer of the Board or other competent and independent person to inspect the premises, and any officer or person so appointed may at all reasonable times enter upon and inspect the premises.

(3) If any person obstructs or interferes with any person authorised to enter on any premises or vessels under this section, he shall, on summary conviction, be liable in respect of each offence to a fine not exceeding ten pounds.

LEGAL PROCEEDINGS

7.—(1) Where an offence under this Act is alleged to have been committed by the master of a vessel who thereafter departs from Great Britain and Northern Ireland before the expiration of the period within which proceedings for the offence might have been instituted against him, proceedings for the offence may, notwithstanding any thing in the Summary Jurisdiction Acts, be instituted against him at any time within two months next after the date on which he first returns to Great Britain or Northern Ireland.

(2) For the purpose of any proceedings for an offence under this Act, the offence may be treated as having been committed either at the place at which it was actually committed or at any place in which the person charged with the offence may at any time be.

(3) Where a fine imposed by any court in proceedings against the owner or master of a vessel for an offence under this Act is not paid at the time and in manner ordered by the court, the court shall, without prejudice to any other powers of the court for enforcing payment, have power to direct the amount remaining unpaid to be levied by distress or poinding and sale of the vessel, her tackle, furniture and apparel.

(4) Proceedings for an offence under this Act shall not be instituted in the case of an offence committed in or in relation to the waters of a harbour except by the harbour authority, and in any other case except by a person authorised in that behalf by special or general directions of the Board of Trade, the Minister of Agriculture and Fisheries, or the Ministry of Commerce for Northern Ireland: Provided that nothing in this subsection shall apply to the institution of proceedings in Scotland.

INTERPRETATION AND APPLICATION

8.—(1) In this Act, unless the context otherwise requires—

The expression "oil" means oil of any description, and includes spirit produced from oil and oil mixed with water:

The expression "harbour" means any harbour whether natural or artificial, and includes any port, dock, estuary or arm of the sea, any river or canal navigable by sea-going vessels, and any waters in which sea-going vessels can obtain shelter or ship or unship goods or passengers:

The expression "harbour authority" includes all persons or bodies of persons, corporate or unincorporate, being proprietors of or entrusted with the duty or invested with the power of constructing, improving, managing, regulating or maintaining a harbour:

The expression "harbour master" includes any person appointed by a harbour authority for the purpose of enforcing the provisions of this Act:

The expression "master" when used in relation to any vessel means the person having the command or charge of the vessel for the time being:

The expression "vessel" has the same meaning as in the Merchant Shipping Act, 1894:

The expression "barge" includes lighter or like vessel:

The expression "transfer" in relation to oil means transfer in bulk:

The expression "local authority" means, in the application of this Act to England, the council of a county or county borough or urban or rural district or a port sanitary authority, in the application of this Act to Scotland the council of a county or burgh or a port local authority, and, in the application of this Act to Northern Ireland, the council of a county, county borough or county district, or a port sanitary authority.

(2) This Act shall apply to any vessel which is capable of carrying in bulk, whether for cargo or for bunker purposes, more than twenty-five tons of oil, or which, though not so capable is constructed or fitted to carry in bulk as aforesaid more than five tons of oil in any one space or container.

(3) The waters to which this Act applies are the territorial waters of Great Britain and Northern Ireland and the waters of harbours therein.

(4) For the purposes of section six of the Government of Ireland Act, 1920, this Act in its application to Northern Ireland shall be deemed to be an Act passed before the appointed day.

SHORT TITLE AND SAVING

9.—(1) This Act may be cited as the Oil in Navigable Waters Act, 1922.

(2) The provisions of this Act shall be in addition to and not in derogation of or substitution for any provisions for the protection of a harbour as defined in this Act contained in any existing Act or re-enactment thereof or in any order, rule, regulation, or bye-law made or to be made under such Act or any re-enactment thereof.

(3) This Act shall come into operation on the first day of January, nineteen hundred and twenty-three.

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New York Electrically Driven Municipal Ferryboats

Propulsion by Squirrel Cage, Induction Motors Supplied With Current by Turbine-Driven Alternating Current Generators

By A. Kennedy, Jr.*

ELECTRIC ship propulsion which was fostered and largely developed through the effort of the General Electric Company has recently entered a new field of application, that is, the propelling of large double-ended ferryboats by means of turbine electric alternating current drive.

Few people, apparently, realized until recently the great advantage to be gained by propelling double-ended ferryboats electrically. For years it has been known that the ordinary bow propeller on double-ended ferryboats was extremely inefficient, but comparatively little has been done to improve the over-all efficiency of such boats.

Special propellers have been designed and built and they have, in certain cases, shown a material saving over the ordinary types of propellers used, but it was not until electric drive was applied to boats of this type that full advantage was taken of conditions known for years to exist in regard to propulsion of double-ended ferryboats.

Propelling Machinery

The three New York ferryboats being built by the Staten Island Shipbuilding Company will each be propelled by an 8-stage condensing Curtis marine type turbine, which has proven particularly well adapted for marine service. This fact is substantiated by the records of the Emergency Fleet Corporation, and also by the fact that approximately 90 percent of the turbine driven ships being built at the present time in England, which is the home of the Parson type turbine, are using the Curtis type of turbine.

Each ferryboat will be equipped with one General Electric turbine-driven alternating current generator, and this generator will in turn drive two marine type 2-speed induction motors having double squirrel cage rotors. In this connection, it is of interest to note that the induction motor rotors being used on the new New York City ferryboats are similar in design to those of the *New Mexico,* which was the first electrically driven battleship.

The relative speeds of the bow and stern propellers were determined by tank tests conducted for the City of New York, under the direction of M. G. Kindlund, naval architect.

The high speed winding will deliver 2,100 shaft horsepower at 176 revolutions per minute and the low speed will deliver 100 shaft horsepower at approximately 122 revolutions per minute.

The apparatus for controlling the motors and generator are of the dead front cell construction type. The general arrangement of the control panel is in brief as follows:

Control Panel

The bottom section includes a master control switch, watthour meter, generator rheostat handle, one electrical control lever, one turbine speed control switch and three manually operated levers. The electrical control lever controls the operation of the solenoid operated contactors. The turbine speed control switch controls the speed of the turbine from the control panel. The manual levers arranged from right to left are—the turbine throttle lever and two levers which are used in case of special emergency for operating the contactors.

*Marine Engineering Department, General Electric Company, Schenectady, N. Y.

The next section includes the various instruments and the top section the contactors.

After the turbine has been started and the hand operated throttle valve thrown wide open, the desired speed of approximately 25 percent of normal speed may be obtained by means of the turbine speed control switch which operates a long range governor. This governor may be operated, if desired, manually, by means of a hand wheel located on the turbine, or the speed controlled by the hand operated throttle valve lever located on the control panel.

Operation of the Electrical Lever

The operation of the electrical lever is as follows:

The first position in either direction will close the line contactors on the stern high speed motor winding. The second position will close the generator field contactors applying approximately double excitation. It should, therefore, be noted that the main line contactors for high speed propelling motor windings are closed on the dead circuits. The propelling motor having started and come in step with the generator, the electric lever will then be moved to the third position which reduces the excitation on the generator to normal. This is done by means of a transfer resistance so that generator field circuit is not opened during this transfer. The ship may then be brought up to the desired speed.

The fourth position of the electrical lever closes the bow slow speed motor contactors, this being the maximum efficiency running position. The slow speed motor winding is so designed that when this motor is operating on this winding it cannot take more than approximately 200 percent current and may, therefore, be easily thrown on the line with full voltage. The water acting on the bow propeller will tend to break the bow propeller loose and, therefore, this motor is not designed for the normal breaking away torque which would be required in case this motor was thrown on the line before the ship was under way.

To stop the ship, the electrical lever is thrown to the off position, there being a certain time interval between the opening of the generator field contactors and the opening of the main propelling motor contactors. This time interval is provided so that the generator field will die down and, therefore, there will be a minimum amount of arcing on the main propelling motor high speed winding contactors. At the same time that the electrical lever is thrown to the off position, the turbine speed will be reduced by means of the electric speed switch. The governor on the turbine is so designed that it will hold constant speed from 25 percent to 100 percent either with or without load.

Maneuvering

The ship may be maneuvered, as described above, either ahead or astern.

In maneuvering, all power is placed on the most efficient propeller for accomplishing the desired result; that is, in stopping the boat, all power will be placed on the bow high speed motor winding, the speed of the motor being controlled by the speed of the turbine.

To further increase the efficiency of these ferryboats, most of the engine room auxiliaries are motor driven, obtaining their power from a 125-kilowatt condensing turbine driven direct current generator.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Allowances for Scrap in Ship Construction

Q. (1172).—What do you consider reasonable allowances for scrap in the cases of some of the principal materials entering into ship construction?

A. (1172).—The following percentages may be taken as reasonable, although there is some variation due to differences in practice in different building yards:

	Scrap—Percent
Plates and shapes	15
Rivets	15
Steel and iron castings	10
Steel forgings	10
Iron forgings	15
Brass castings	10
Bronze	10
Zinc	10
Lead and copper	net
Rubber	10
Decking (white or yellow pine)	10
Tarred felt	net

Resistance Due to Foul Bottom

Q. (1173).—Can you give me any information as to the relation between time out of dock and resistance due to foul bottom?

A. (1173).—Only very general information can be given in answer to your question because the result in a given case depends upon the temperature and the degree of salinity of the water, the speed of the ship through the water when under way, and the proportion of the time out of dock which has been spent in actual steaming.

Admiral Taylor in "Speed and Power of Ships" states that in extreme cases of fouling a vessel's bottom may have a complete incrustation of shell fish and this may result in skin resistance four or five times that of the clean ship. He states further that, in practice, such fouling is permitted only under exceptional circumstances, vessels being docked at intervals. But even in cool waters when fouling usually goes on rather slowly a vessel three or four months out of dock is liable to have an increase of 20 percent or more in skin resistance, and in tropical waters the increase of resistance is greater.

In a certain case with which the writer is familiar a vessel divided her time about equally between cool and warm waters. She spent a short time in fresh but most of her time in salt water. She spent about twenty percent of the entire time in actual steaming at slow speeds. During her first six weeks out of dock her resistance increased about fifteen percent. Thereafter for about seven months the increase was gradual and quite uniform. At the end of the period of nine months out of dock the resistance had increased 30 to 40 percent over that on leaving dock.

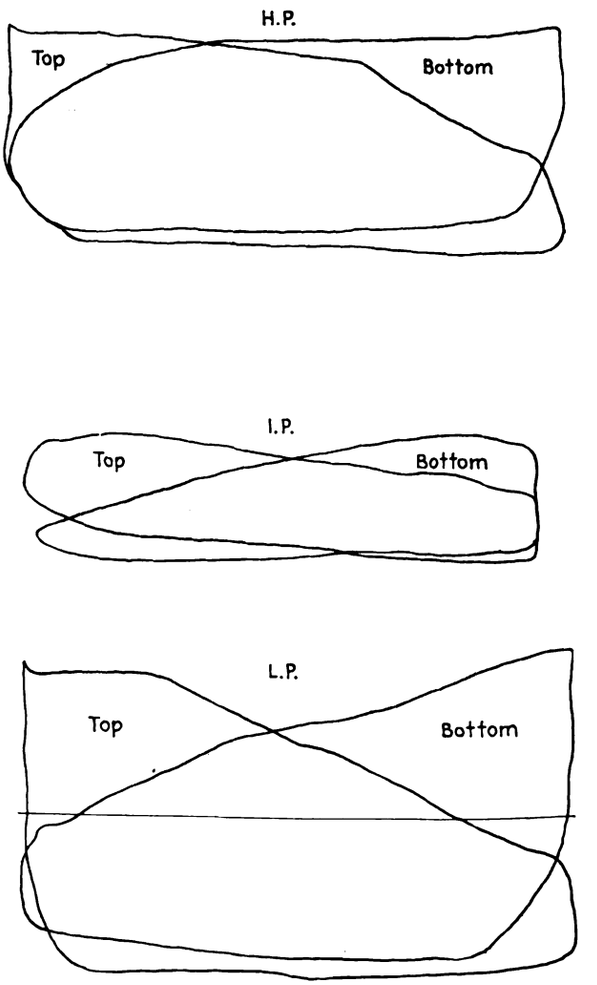
Valve Gear Setting

Q. (1170.)—What does the enclosed set of indicator cards indicate as to the valve gear setting and how should the valves be corrected? The engine cylinders are 27 inches, 44½ inches and 73 inches in diameter by 54 inches stroke. The steam pressure is 190 pounds per square inch.

A. (1170).—The comments which follow may be in error because of insufficient information and the faintness of the high pressure card. Certain assumptions had to be made, therefore, it does not seem safe to suggest changes either in the valve setting or to the valves.

High Pressure Cylinder.—Bottom release late as is also the bottom cut off.

Intermediate Pressure Cylinder.—Top card shows excessive compression and late admission. Bottom card shows late compression and early admission. The peculiar shape of the top right corner may be due to a leaky high pressure valve or a small receiver from the high pressure to the intermediate pressure steam chest, and the late high pressure



Set of Indicator Cards from Triple Expansion Engine

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bottom release, steam coming to the intermediate pressure valve but little faster than it is being used, thus causing the horizontal steam line. Then the high pressure exhaust port begins to uncover more rapidly than the intermediate pressure steam port opens and pressure is built up in the receiver causing the steam line to rise.

Low Pressure Cylinder.—Both top and bottom cards show early compression and the bottom card late admission and release. The top card as a whole is not bad.

In order to study this problem for recommendations with any degree of assurance it would be necessary to know the order of the cranks and the side on which steam is taken for each valve, also the valve diagrams, if available.

Non-Shatterable Glass Introduced in the Marine Field

A NON-SHATTERABLE glass, manufactured by the Indestructo Lens and Windshield Company, Brooklyn, N. Y., which has found wide application in commercial service of various kinds, has been adapted to marine service. This glass is specially used for port lights where it is necessary to protect the ship against water damage. Wherever ordinary glass can be broken by wave action or other causes this indestructible glass may be utilized to advantage.

"Indestructo" glass is of laminated construction consisting of alternate layers of glass and pyralin welded into a solid homogeneous mass under pressure and intense heat. Vision is in no way impaired by the process and it is stated by the company that when the glass has been cracked through accident its structural strength is not materially decreased but can be continued in service indefinitely and afford protection against water damage. In tests conducted for Navy service the glass has been subjected to pressures up to 500 pounds per square inch without destroying the glass beyond usefulness. On naval vessels this glass is used almost exclusively; in merchant service it has been used for binnacle covers, gage glasses, battery boxes, glass doors and door windows, port lights, etc.

In reconditioning the *Leviathan* this glass is being used to replace the lights in 525 ports. "Indestructo" glass is being distributed by the Protective Appliance Company, 232 Vanderbilt avenue, Brooklyn, N. Y.

NEW BOOKS

THE WELDING ENCYCLOPEDIA, Second Edition. Edited by L. B. Mackenzie and H. S. Card. A reference book on the theory, practice and application of the four autogenous welding processes. Size, 6 by 9 inches. Pages, 388. Illustrations, 550. Chicago, Ill., 1922: The Welding Engineer Publishing Company.

The first half of this book consists of a dictionary of all words, terms and trade names used in the welding industry. Included in this arrangement are instructions for welding operations on the most common types of repair work and production work, descriptions of the modern methods of testing welds, specifications for welding rods and wires for all classes of work, and descriptions of the application of welding to the various industries, such as automobile repairing, refrigerating machinery, structural steel, etc. Following the dictionary section are separate chapters on oxy-acetylene welding, electric arc welding, electric resistance welding and thermit welding. Complete descriptions of each one of these processes are given, followed by general operating instructions and special instructions for the application of each process to every metal which can be welded by it. Separate chapters are included on the subjects of boiler welding, tank welding, pipe welding and rail joint welding. Another section is devoted to the rules and regulations enforced by Federal and State authorities and insurance companies on the construction, installation and operation of welding equipment and on their application to various structures. A special chapter deals with the heat treatment of steel, one of the most important metals which the welder handles. A collection of charts and tables shows the variety of methods of preparing joints for welding, gives information on the characteristics of all the commoner metals, shows how to tell the temperature of metals by a color chart, and also shows a color chart explaining the proper adjustment of the oxy-acetylene flame. The catalogue section at the end of the book describes and illustrates the standard lines of welding equipment and apparatus.

Practical Guide for Diesel Engine Operators

Reviewed by A. J. C. Robertson*

NOTES AND SKETCHES ON MARINE DIESEL OIL ENGINES. By J. W. M. Sothern, M.I.E.S., M.I.Mar.E. Size, 6 by 9¼ inches. Pages, 400. Illustrations, 230 (including many folding plates). New York, 1922: D. Van Nostrand Company.

Marine engineers generally are well acquainted with Mr. Sothern's previous books, "The Marine Steam Turbine," "Verbal Notes and Sketches for Marine Engineer Officers," etc., and this new volume is a welcome addition to this list.

In the new book Mr. Sothern covers practically all the phases of interest to the practical operating marine engineer who wishes to take up a study of Diesel engines with a view to being put in charge of these.

The book is divided into sections covering full descriptions of the various Diesel engines and their installation and practical operation, and also illustrating and explaining the various systems of starting gear in use, and the Diesel indicator diagrams and what they mean. Attention is also given in the book to the various auxiliaries in the engine room of a Diesel ship, and a number of questions and answers on Diesel oil engine practice are included which should prove of value to those taking examinations for certificates.

The section on indicator diagrams is particularly valuable as little information of this kind is at present available; the same might also be said of the article on fuel oil.

The book is splendidly illustrated by a large number of plans, sketches and large drawings, and is fully up to date, including such recent developments in Diesel engines as the Doxford and similar opposed piston engines, and the compound Still Diesel-steam engine.

In every way this book is a thoroughly satisfactory guide to a practical Diesel engine operator and should be in the hands of all those who contemplate taking charge of such machinery.

Very wisely the author has left out of his book the large and somewhat complicated question of heat stresses and the general questions of design such as propeller efficiency and revolutions and weights of the various types of engines as these are influenced by length of stroke, etc., and has confined himself to the information especially desired by those for whom the volume is prepared.

The Lloyd Sabaudo's new liner *Conte Verde*, sister ship of the *Conte Rosso*, was successfully launched at Glasgow, Scotland, on October 21. The Lloyd Sabaudo will place the *Conte Verde* in the New York-Mediterranean run beginning in the spring of next year.

*Naval architect, Munson Steamship Line, New York.

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Captain William Lyons Made Commodore of American Hawaiian Fleet

Captain William Lyons was recently assigned to the command of the motorship *Californian,* at which time he was made commodore of the American-Hawaiian Steamship Company's fleet of twenty-one vessels. Captain Lyons became first officer of the American-Hawaiian steamship

Commodore William Lyons

Hawaiian in 1900 and has served continuously under the house flag of this company up to date. He was master of the steamers *Missourian* and *Montanan* when they were sunk by submarines during the late war. Under his command the *Californian* recently completed her maiden voyage of 21,000 miles from New York to the Pacific coast thence to Europe and return.

OBITUARY

HENRY F. MILLER, Philadelphia manager for Henry A. Kissel Company, dealer in ship supplies, recently died in that city following an operation. Mr. Miller was a member of the Maritime Exchange for many years representing S. P. Blackburn & Company and subsequently entered the employ of Kissel Company.

JOHN R. BINNING, manager for Canada and Newfoundland of Furness, Withy and Company, Ltd., recently died at Montreal at the age of fifty-six years. He was born at Hamilton, Scotland, and, after completing his education, was employed for a short time in the ship business in Scotland. He entered the service of the Canadian Pacific Railway in 1888 and ten years later became assistant manager of Furness, Withy and Company, Ltd., which position he held until 1903 when he was made general manager with headquarters in Montreal. In recognition of the service he rendered during the war, Mr. Binning in 1920 was appointed to the office of manager for Canada and Newfoundland.

PERSONAL MENTION

O. L. SMITH, JR., formerly manager of the Black Diamond Steamship Corporation's Baltimore office, has been promoted to the position of general manager of the Black Diamond Steamship Corporation at the head office in New York.

ARTHUR A. GRANT, who resigned as vice-president and southern resident director of the Sinclair Refining Company with headquarters at New Orleans, has been appointed general manager of the Jahncke Dry Docks, Inc., of the same port.

FREDERICK I. THOMPSON, commissioner of the United States Shipping Board, representing the interests of the Gulf section, will retire from the Board within a short time. Mr. Thompson has recently become owner of the *Birmingham Herald,* which has made it necessary to give up his duties on the Shipping Board.

CAPTAIN R. L. MARTIN recently retired from the Robert Dollar Line after fifteen years' service, the last few years of which he served as marine superintendent at Vancouver. It is stated that he will organize a new shipping firm in association with Melville Dollar who has also retired from the Robert Dollar Company.

WILLIAM SIMMONS, of the Simmons Transportation Company, the Jarvis Lighterage Company, Lee and Simmons, Inc., and a former president of the Maritime Exchange, was elected a commissioner of pilots at a special meeting of the Chamber of Commerce of the State of New York to serve for three years in place of Arthur M. Smith who died recently.

HUGO P. FREAR, naval architect of the Bethlehem Shipbuilding Corporation, Bethlehem, Pa., and Ernest H. Rigg, naval architect of the New York Shipbuilding Corporation, Camden, N. J., have been appointed delegates to represent the American Marine Association at an informal conference on standardization called by Secretary Hoover of the Department of Commerce and to be held in the auditorium of the Grand Central Palace, New York, on Friday, November 10.

F. P. GUTHRIE, head of the radio division operating department of the United States Shipping Board Emergency Fleet Corporation, has been designated by Chairman Lasker as the representative of the Shipping Board and Emergency Fleet Corporation to serve as a member of the inter-departmental committee on electrical communications. Mr. Guthrie was a delegate to the Inter-Allied Communication Conference at Paris last summer. He has been with the Emergency Fleet Corporation since May, 1919.

R. STANLEY DOLLAR, one of the largest stockholders of the Pacific Steamship Company (the Admiral Line) but who has not been active in its affairs, has been induced to take up his residence in Seattle, Wash., and to form a new company to be known as the Admiral-Oriental Line to which the Shipping Board allocated its ships running out of Seattle. Mr. Dollar, who is one of the most experienced operators in the Far Eastern trade, will hold the position of president of the new line devoting his entire time to the enterprise. A. F. Haines, who formerly managed the government ships for the Pacific Steamship Company, has been made vice-president of the new company. Mr. Dollar retains his interest in the Pacific Steamship Company, the present arrangement merely bringing all the government ships under the control of a company that will devote its entire time to their operation.

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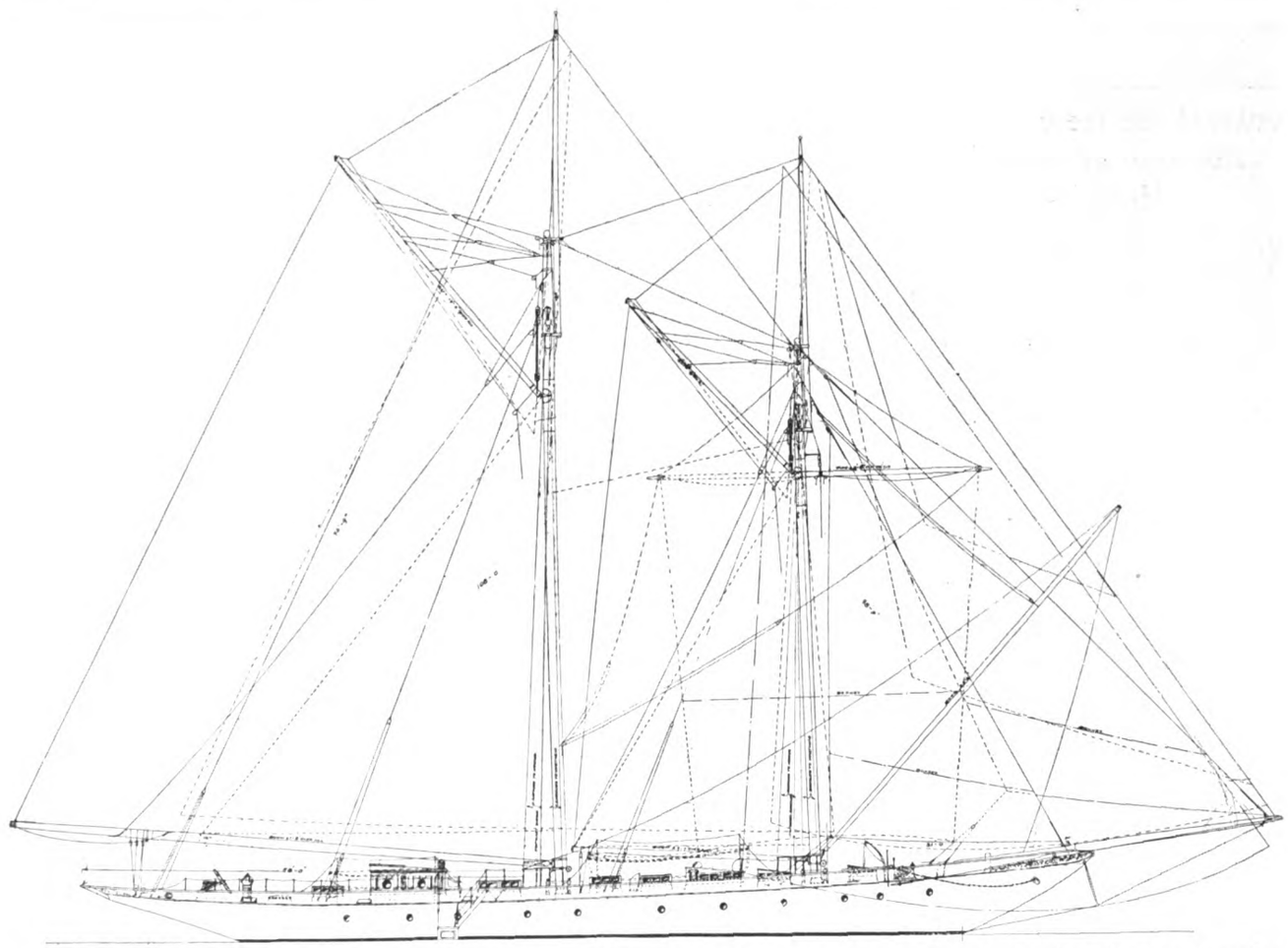
Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry



OUTBOARD profile of two-masted steel auxiliary schooner designed by Theodore E. Ferris, naval architect and marine engineer, New York City, for William P. Adams, Esq., of Chicago, Ill. Vessel will be 125 feet over all, driven by oil engines, and bids for construction have been asked. She will cost about $100,000.

Contract for Another 12,000-Ton Steel Bulk Freighter Awarded Great Lakes Engineering Works

THE placing of another contract for the construction of a 12,000-ton steamer, as an addition to the bulk freight fleet, is the latest announcement from the Great Lakes district. The Great Lakes Engineering Works, of Detroit, Mich., is given as the successful shipyard, the new vessel to be built for the Cleveland-Cliffs Iron Company. Although official figures were not given, it is understood that the cost of the ship will be close to $800,000.

The new vessel will be a duplicate of the steamer *Pontiac*, of the iron company's fleet, being 600 feet over all length, 580 feet keel, 60 feet beam and 32 feet deep. She will be driven by a triple expansion engine, steam being furnished by three Scotch boilers.

This contract makes eight steamers of the 600-foot class that have been ordered since last May. Two of the boats will be built by the Great Lakes Engineering Works, five by the American Shipbuilding Company and one by the Toledo Shipbuilding Company. All the new boats will be operated in Cleveland. All the big freighters are for 1923 delivery except the steamer *James McNaughton*, which is building for the Wilson Transit Company by the Great Lakes Engineering Works.

Contract Reported Placed for the Red "D" Line Steamers

A PERSISTENT report in marine circles, credits the New York Shipbuilding Corporation with having been awarded the contract for the construction of one and possibly two new steel passenger and cargo ships for the Red "D" Line. While official information was withheld, there was a strong impression that the award has been made, the cost of each ship being unofficially estimated as in the neighborhood of $700,000. It is understood that propulsion will be by turbine engines.

The vessel will have an over all length of 320 feet, according to specifications issued recently, and will be of the two-deck shelter deck type, driven by twin screws.

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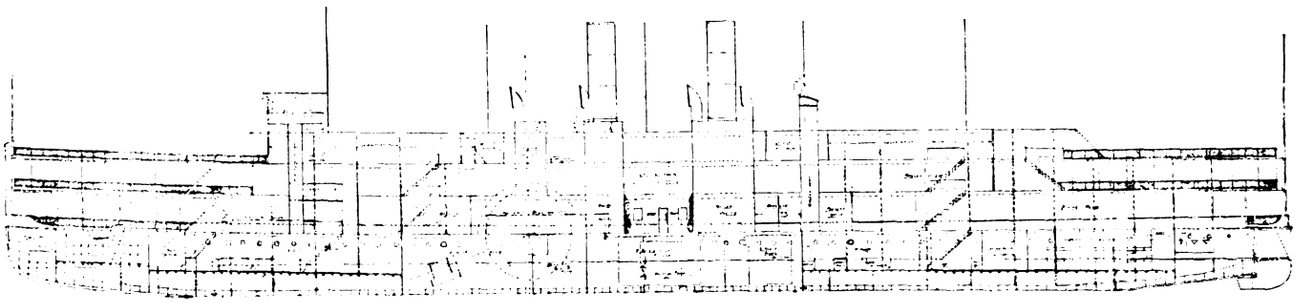

Inboard Elevation of Proposed New Steamer

Contract for New Steamer Awarded Bath Iron Works

A CONTRACT for the construction of a new passenger vessel for the New Bedford, Martha's Vineyard and Nantucket Steamboat Company, a subsidiary of the New England Steamship Company, has been awarded to Bath Iron Works, of Bath, Me. The new vessel will be a single-screw boat 200 feet in length, driven by a triple expansion steam engine.

Half A Million May Be Cost of Three-Ship Job

A HALF million dollar ship conversion job, involving three unfinished ships at Pascagoula, Miss., will be undertaken in the near future, according to latest reports from that city. The ships involved are hulls of steel construction, about 385 feet in length, built by the International Shipbuilding Company, of Pascagoula. They were originally intended for steam propulsion, one ship being so far completed that she will be finished as intended, the other two hulls, which are only partially completed, are to be equipped with Diesel engines.

Plans and specifications for the reconditioning work were prepared by Whittelsey & Whittlesey, naval architects, of 17 Battery Place, New York, tenders being received on Monday, October 16.

It is understood that the three hulls have been launched and were designed as cargo ships.

Steamer Covedale Will Be Converted to Oil Engines

BIDS have been received by the Munson Line for the conversion of the steamship *Covedale*. One of the two Scotch boilers now in the ship will be retained, as will most of the steam auxiliaries. New foundations for the engine and a number of new auxiliaries will be installed, the new propulsion to consist of one 900-brake horsepower McIntosh & Seymour Diesel engine, which was purchased by the Munson Line from the Shipping Board.

Tenders submitted October 5 were:

Tebo, $56,860, 58 working days.

New York Harbor, $64,688, 50 cont. running days.

Federal, $68,000, 60 days.

Newport News, $68,000, 75 cont. running days.

New York Ship, $78,500, 90 running days.

Merchant Ship, $79,000, 14 weeks.

Specifications Prepared for Oil Burning, Side Wheeler to Be Added to Hudson Day Line Fleet

Vessel Will Have Length of 338 Feet, Propelled by Triple Expansion Steam Engines—Is to Have Two Single and Two Double Ended Scotch Boilers

PLANS and specifications were prepared by J. W. Millard & Brother, naval architects, 17 State street, New York City, for the construction of a new paddle wheel steel steamer for the Hudson River Day Line, bids having been received on October 20. The principal dimensions of the proposed steamer are length over all 338 feet, extreme breadth 76 feet, depth molded to main deck at side guard 13 feet 8 inches. The vessel will be propelled by a diagonal inclined triple expansion steam engine and she will be of a type equal to the steamer *Robert Fulton*.

HULL

The hull is to be built of steel on the transverse system and there will be two keelsons on each side of the middle line worked over the floors amidships. Tanks for the storage of oil fuel are to be built in the hull on each side in the forward boiler room.

There are to be five cylindrical fresh water tanks built of No. 12 B. W. G. steel plates, galvanized with single riveted seams and double riveted butt straps calked and made watertight.

EQUIPMENT

Chocks, cleats and fairleads are to be of cast steel of approved pattern similar to those on the steamer *Washington Irving*. There will be provided and fitted ready for use four pairs of davits for 22-foot lifeboats made of 3½-inch double extra thick steel pipe. The anchor davit of 3½-inch double extra thick steel pipe is to be complete with all fittings similar to that on the steamer *Robert Fulton*.

There is to be an American Engineering Company or other approved combination hand and steam power capstan located on the main deck forward. The capstan is to be fitted with a wildcat for 1-inch diameter anchor chain and to be large enough to handle the anchor and 7-inch lines.

Two approved hand deck pumps of brass of suitable size for the steamer, with their necessary sea and bilge valves and pipes, are to be fitted complete, as required by law.

The steamer is to have four metallic lifeboats of approximately 20 feet by 6 feet by 2 feet 5 inches; also one working boat 14 feet by 4 feet 6 inches by 1 foot 9 inches.

One 1,200-pound stockless anchor and one 600-pound stockless anchor with 60 fathoms, of 1-inch diameter, galvanized crane chain with proper shackles, etc., are to be supplied.

MACHINERY

The vessel will be propelled by paddle wheels of the feathering type, driven by an engine of the diagonally inclined, triple expansion, surface condensing type. The high pressure cylinder is to be in the center with one intermediate pressure cylinder on one side and one low pressure cylinder on the other. The general design of the engine and the character of workmanship and finish of all the machinery is to be like that of the steamer *Washington Irving*. The engine, in all its parts, is to be proportioned for a working boiler pressure of 180 pounds per square inch and 40 revolutions per minute. The paddle wheels are to be about 22 feet 5 inches in diameter, each having nine paddles about 12 feet 6 inches long by 3 feet 9 inches wide.

The main condenser will be separate from the main engine, built of wrought steel plate and will have about 5,800 square feet of cooling surface.

There will be one centrifugal circulating pump, worked by a vertical steam engine; a complete set of independent air, feed, sanitary, fire and trim tank pumps, electric light plant, steam steering engine, feed water heater, steam fan blowers for forced draft and ventilation, oil heaters and pumps, and such other supplementary machinery, instruments, etc., as may be necessary to make the installation complete.

BOILERS

There will be two single ended and two double ended cylindrical, horizontal, Scotch type boilers to be allowed a working pressure of 180 pounds. Each boiler is to be 12 feet 1 inch inside diameter and 11 feet 4 inches length over top head for the single ended boilers and 22 feet over the top head for the double ended boilers.

Each single ended boiler is to have about 2,100 square feet of heating surface and each double ended boiled about 4,200 square feet of heating surface.

Each single ended boiler will have two furnaces and each double ended boiler four furnaces, 42 inches least inside diameter, and arranged to be taken out and revised without disturbing the boilers.

FUEL OIL BURNING SYSTEM

The steamer is to be furnished and fitted complete with the White Fuel Oil Engineering Corporation mechanical fuel oil burning system and there will be installed in the engine or boiler room two fuel oil pumps, three fuel oil heaters, duplex suction and discharge strainers, with all usual fittings.

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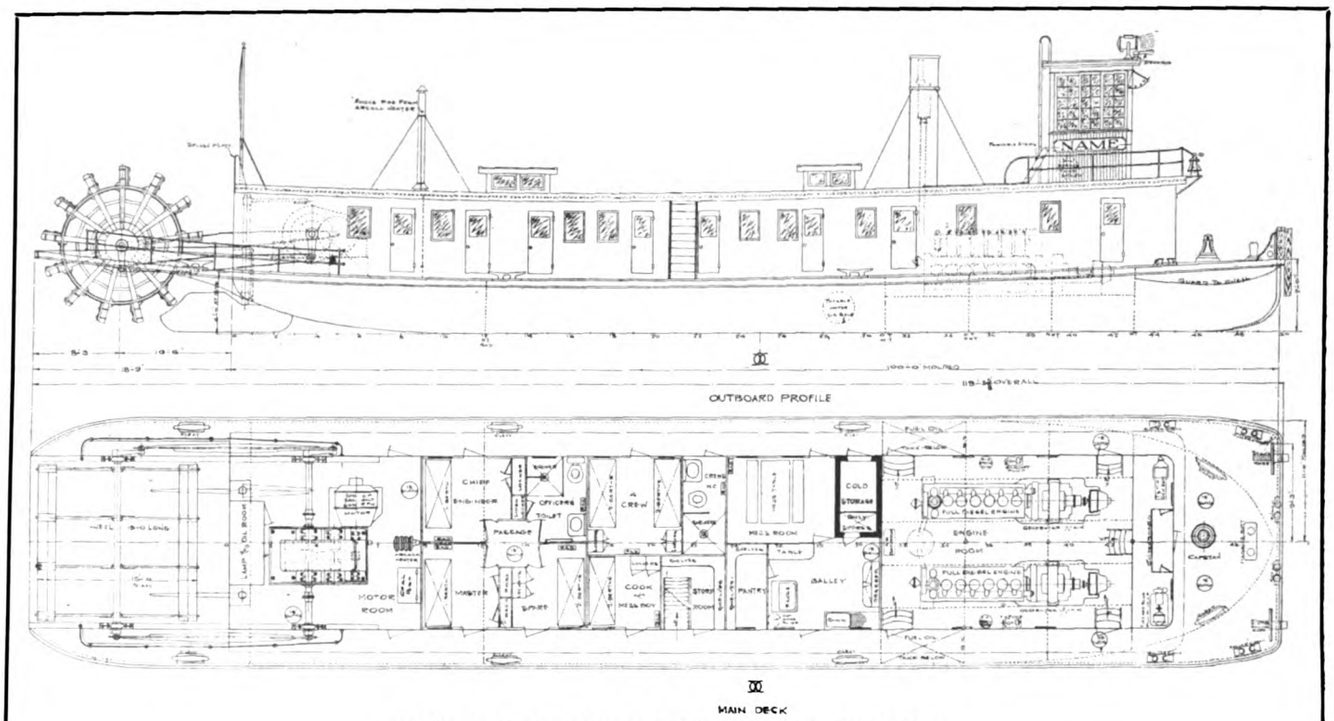

Profile and Deck Plan of Diesel-Electric River Tug

Charles Ward Engineering Works Submits Low Price for Building 100-Foot Diesel Electric Towboat

THE CHARLES WARD ENGINEERING WORKS, of Charleston, W. Va., submitted the lowest price for the construction of a 100-foot Diesel electric towboat for the U. S. Engineer Office, Mobile, Ala., at the opening of tenders on October 10. The Ward Company gave a price of $89,000 and 200 days, with Winton 6-cylinder 4-cycle main engines, Westinghouse main electrical machinery and Fawcas reduction gears.

The proposed vessel will have an over all length of 119 feet 3⅝ inches, breadth molded 23 feet, depth 5 feet, draft loaded 3 feet. She will be built according to American Bureau of Shipping Rules. Two Diesel engines are to be installed and they are to be a standard commercial product of American manufacture. Prices submitted provided for Worthington, Winton, McIntosh & Seymour and New London Ship & Engine Company types of main engines.

Two Tankers May Be Converted From Turbines to Diesels

GEORGE G. SHARP, naval architect, and marine engineer, of 30 Church street, New York City, has in hand a proposition for the conversion of two 7,500-ton tankers from geared turbine drive to Diesel drive. The engines to be installed are to be about 2,500 brake horsepower each.

Steamer Aztic Awarded Newport News Shipyard

ANNOUNCEMENT is made of the awarding of the contract for damage repairs on the steamship *Aztic*, to the Newport News Shipbuilding Company, on a bid of $14,643 and 12 days' time. Tenders were opened by Harald Nervik and R. Beylegaard, owners' representatives office, 59 Pearl street, New York. The prices submitted were as follows:

Sun Shipbuilding Co.....	$13,894	14 days
Tietjen & Lang.....	14,110	17 days
Newport News Shipb'd'g Co.	14,643	12 days
Morse Dry Dock & Rep. Co.	16,000	17 days
Bethlehem Shipb'd'g Corp..	18,977	16 days

Three Contracts Awarded Johnson Plant, New Orleans

A CONTRACT to repair the damage caused by a hurricane to the United States Shipping Board tanker *Danville*, while the vessel was in Tampico Harbor, has been awarded the Johnson Iron Works, New Orleans, La., on a figure of $14,923.

The Johnson plant also has the Mississippi Warrior tug *Gupsum Prince* for repairs to machinery and hull, amounting to about $3,000. The Shipping Board steamship *Lake Clearport* was drydocked at the same yard for minor repairs.

Oil Conversion Job

The Joseph Frolich Iron Works, Inc., of New Orleans, La., has been awarded the contract to convert the tug *Panther*, owned by the Alexander Towing Company, of New Orleans, into an oil burner.

The Frolich Works is also busy with its two harbor floating repair plants, making repairs to the following ships: *Yumi*, of the Mexican Fruit Company; the *Ciba* and the *Caloria*, of the Vaccaro Brothers; the *Olancha*, of the Cuymel Fruit Company; the *Jacob Luckenbach*, of the Luckenbach Lines.

Buffalo Engineer Office Will Build Three Steel Scows

UNITED STATES ENGINEER OFFICE, of Buffalo, N. Y., will receive sealed proposals until 11 A. M. on November 6 for the construction of three 400 cubic yard steel dump scows. The boats are to have a length molded of 110 feet, breadth molded 32 feet, and unless otherwise specified, shall be built to the American Bureau of Shipping rules.

Contract Placed for Three Steel Bulk Oil Barges

A CONTRACT has been awarded the Alex Dussel Iron Works, of New Orleans, La., for the construction of two steel oil barges, 100 feet by 22 feet by 5 feet, with six compartments, and one 100 feet by 16 feet by 5 feet, with five compartments, for the Consolidated Company, Inc., of Plaqueminc, La.; price $17,000. The company will fabricate the steel at their plant on Clio Street and assemble the boats on the river front.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Drydocked, New Orleans, La.—Tanker Danville, damaged by a storm, went to New Orleans to be drydocked.

Repairs to Steam Schooner, North Vancouver.—Steam schooner Fred Baxter went to Wallace Dry Dock to undergo repairs.

Motorship Drydocked, Galveston, Tex.—Motorship Whipple, of the Snyder Banana Company, went to Galveston to be drydocked.

Steam Schooner Drydocked, Portland, Ore.—Steam schooner Daisy Freeman went on drydock at Portland to install a new propeller.

Barge Drydocked, Chester, Pa.—The Atlantic Refining Company's motor barge No. 68, went to the Sun Shipyard, Chester, for repairs.

General Repairs, Jacksonville, Fla.—The Dio, consigned to Southern Shipping Company, went on drydock at Jacksonville for general repairs.

Schooner Drydocked, Portland, Ore.—The schooner Dauntless was lifted on the Port of Portland drydock for cleaning and painting the hull.

Steamer Repairs, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded repairs on the Shipping Board steamer Lake Gilmore.

Repairs to Tanker, Chester, Pa.—Tanker R. D. Leonard, of the Atlantic Refining Company's fleet, was drydocked at Sun Shipyard for miscellaneous repairs.

Steamer Inspection, Long Island, N. Y.—Steamer Medon went to Hunter's Point drydock to be inspected by representatives of the Alaska Steamship Company.

Steamer Reconditioned, San Pedro, Cal.—The Elabe, of the same company, went to the Los Angeles Shipbuilding and Dry Dock Corporation to be reconditioned.

Battleship Drydocked, San Francisco, Cal.—The dreadnaught New Mexico of the Pacific fleet went to the Hunters Point drydock to have new propeller blade installed.

Reconditioned for Lumber Trade, West Coast.—The El Cedaro, of the Los Angeles Lumber Products Company, will be drydocked soon to be reconditioned for the lumber trade.

Freighter Converted to Oil Burner, San Francisco, Cal.—Matson freighter Coverun went on ways at Bethlehem shipbuilding plant to undergo a change from coal to oil burning.

Steamer Drydocked, Seattle, Wash.—Steamship Queen, of the Pacific Steamship Company, went to Seattle to be drydocked for survey, as a result of damage made by grounding.

Negotiating for Tanker, San Francisco, Cal.—The Associated Oil Company, of San Francisco, is reported as negotiating for the purchase of a 4,000-ton tanker on the East Coast.

Conversion to Oil Tanker, West Coast.—Robert Dollar Line will convert the bark William Dollar into an oil tanker for the purpose of hauling fuel from the Pacific Coast to the Orient.

Lighthouse Tender Drydocked, Savannah, Ga.—Lighthouse tender Cypress went to the Wilkinson Machine Company to be scraped, painted and to have her engines thoroughly overhauled.

Repairs to Steamer, Mobile, Ala.—Shipping Board steamer Salvation Lass went to plant of the Alabama Dry Dock Company for minor repairs to her boiler, renewing a number of bad tubes.

Auxiliary Schooner Surveyed, Seattle, Wash.—The auxiliary power schooner Anvil went to Seattle to be surveyed as a result of striking Kelp reef and having her starboard bow considerably damaged.

Installation of Diesel Engines, Camden, N. J.—New York Shipbuilding Corporation will install Diesel engines on the steamship Jacksonville, purchased from the Shipping Board, and will offer her for sale.

Work on Barge, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded following work on the barge Oriole; installation of new boiler, together with necessary braces, hood, umbrella, stack, etc.

New Ferry Ordered, Detroit, Mich.—Great Lakes Engineering Works were awarded contract to build a ferry steamer for the Detroit-Walkerville route. She will have a capacity for forty-five automobiles and 2,000 passengers.

Cleaning and Painting Contracts, California.—Southern Pacific ferryboat Santa Clara went on drydock to undergo cleaning and painting and the Union Oil Company's carrier Oleum went on the Moore ways to also be cleaned and painted.

Reconditioning Contract, San Francisco, Cal.—The contract for reconditioning the two full-rigged ships, Arrapahoe and Edward Sewell, recently purchased by the Alaska Packers' Association, was awarded to the Moore Shipbuilding Company.

Scraping and Painting, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded contract for scraping and painting the tug Echo. Specifications also called for welding seams on front head of boiler and machinery repairs.

Repair Contracts, West Coast.—The General Engineering Company, of San Francisco, Cal., low bidder, was awarded general repairing work on three steamers, President Lincoln, Colombia and Wilhemina. Prices, in succession, $2,485, $595 and $158.50.

Shipyard Contracts, West Coast.—The Moore Shipbuilding Company, of Oakland, Cal., was awarded the following contracts: Steamers Floridian, West Katan, dredger San Pablo, steamers Covina, Coquille, tanker La Purisima and barkentine City of Sydney.

Barges Repaired, Mobile, Ala.—Barges Juniata and Susquehanna, of the Gulf Refining Company, went on the large dock of the Alabama Dry Dock & Shipbuilding Company. They require reconditioning of a number of shell plates, frames, rail stanchions, etc.

Steamer Drydocked, San Francisco, Cal.—Admiral Line steamer Admiral Schley went to Union Iron Works to be cleaned and painted. Bottom was scraped and cleaned, vessel to have two new coats of paint. Two new propellers replaced those already on the ship.

Repair Work, San Francisco, Cal.—The Moore Shipbuilding Company was awarded the following contracts: U. S. army transport Grant, to overhaul engines, etc., price $10,000; steamer Manukai, general overhauling, and steamers Edna and Alaskan, general repairs.

Repairs to Steamer, Quincy, Mass.—The Bethlehem plant at Quincy was awarded the contract for the following repairs to the steamer Calvin Austin, which went ashore in the Cape Cod Canal; replacing of stern frame, new rudder, keel plates and repairs to the forward section.

Steamer Reconditioned, New Orleans, La.—Contract for reconditioning United States Shipping Board steamer West Wauna was awarded to Jahncke Dry Dock Company. Overhauling included general repairs and furnishing and installing of a new set of Falk gears. Price $17,037.

Contract Awarded, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company was awarded the contract for installing a new rudder and miscellaneous bottom work on the towboat Montgomery and also for repairs to the towboat Demopolis, both of the Mississippi Warrior Line.

Reconditioning Contracts, New Orleans, La.—The Johnson Iron Works was awarded the contracts for docking and repairs to Mississippi Warrior tugs, the Baton Rouge and Cairo, steamship Craster Hall, steamships Isabella and Manta, steamship Blue Hill, towboats Ruth and Cadmaus.

Painting and General Repairs, Mobile, Ala.—Gulf Refining Company's tug Senator Bailey went on dock of the Alabama Dry Dock Company for painting; installing new tail shaft; repairs around the hull and engine, including furnishing and installing new air pump to replace the one previously on board.

Barge Launched, New Orleans, La.—The Johnson Iron Works, Dry Dock and Shipbuilding Company, Inc., launched the last of the six barges to be sent to the United States Engineers at Mobile, Ala. The barges are made of steel, two having cabins, the last being 87 feet long, 28 feet 4 inches beam and 7 feet deep.

Contract Awarded, Brooklyn, N. Y.—Robins plant of the Todd Shipyards Corporation was awarded the contract for reconditioning the Texas Company's steel tanker Louisiana. In addition to reconditioning, Todd mechanical fuel oil burners and necessary auxiliary equipment will be installed. Price $100,000.

Tanker Repairs, Mobile, Ala.—Shipping Board steamer Duquesne was awarded to Todd Shipbuilding and Dry Dock plant, Mobile, for repairs, including installing of new set of reduction gears and extensive repairs on main turbines, necessitating removal from vessel of practically all propelling machinery.

Miscellaneous Repairs to Steamer, Chester, Pa.—Sun Shipbuilding Company was lowest bidder for contract to repair Japanese steamship Kashu Maru, damaged in collision. Sun yard bid $4,435 for repairs to counter, renewing several plates, fairing others, reconditioning steering gear and making miscellaneous repairs.

New Steel Barges, Pittsburgh, Pa.—American Steel and Wire Company has ordered twenty new steel barges from the American Bridge Company at a cost of $340,000. They are to be 175 feet long, twenty-six feet wide and eleven feet deep, and will be used for transport of coal and billets in the Monongahela and Allegheny rivers.

Repair Contracts, Hoboken, N. J.—The Tietjen & Lang plant of Todd Shipyards Corporation was awarded the contract for rebuilding the hull of the Mallory Line tug President; cost about $12,000. Same yard also reconditioned the ferryboat Syracuse and barges of the Clyde Line, Southern Pacific Company and D., L. & W. and Lehigh Valley Railroads.

Conversion Contracts, Brooklyn, N. Y., and Hoboken, N. J.—Contract for conversion of four ships of the Southern Pacific Steamship Company from coal to oil burning vessels was awarded to the Todd Shipyards Corporation; total cost about $336,800. Ships involved were El Siglo and El Cid, Robins Yard, Brooklyn, N. Y.; and El Dia and El Rio, Tietjen & Lang plant, Hoboken, N. J.

Steamship Overhauled, Camden, N. J.—Passenger and freight steamship Jacksonville, owned by the Merchants' and Miners' Transportation Company of Baltimore, was towed to yards of the New York Shipbuilding Corporation for extensive alterations to passenger quarters and a complete overhauling. She will probably be converted from triple expansion steam engine to Diesel-engine propulsion.

Reconditioning Jobs.—Bids submitted for repairs and reconditioning for three ships were as follows: Foreign Transport & Mercantile Corporation steamship Winnebago, Staten Island Shipbuilding Company, $4,721—33 days; United Fruit Ship Norma of Delaware, Morse Dry Dock & Repair Company, $14,650; and Baltimore & Carolina Steamship Company's steamer Tipton, Crook Shipyard, $212,790.

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Installation of Boilers, Pittsburgh, Pa.—The Pearson Manufacturing Company received the contract to install a battery of three boilers on steamer National of the J. K. Davison & Brothers. They will be of the two-flue type, 38 inches wide and 26 feet long. The company also completed repairs to the boilers and machinery of the steamer Hibernia, owned by the Equitable Towing and Transportation Company.

Construction Contract, Amsterdam, Holland.—The Nederland Shipbuilding Company (Nederlandsche Scheepsbouw-Maatschappy), Amsterdam, have obtained an order from the Colonial Department for a cable-ship for the East Indies, named Zuiderkruis. The ship's dimensions are to be as follows: Length over all, 290 feet 10 inches; breadth molded 36 feet 9 inches; depth 22 feet 2 inches. The engine installation will be supplied by Werkspoor, Amsterdam.

Work on Great Lakes.—Great Lakes Engineering Works, Ecorse, Mich., was awarded the following contracts: Construction of 12,000 ton steamer James McNaughton; large amount of work on boats of smaller class; automobile carrier Fellowcraft, minor repairs; steamer M. G. Hausler, repairs to nine plates; tug Sidney T. Smith, to receive new stern and general overhauling; steamer Wesee and barge Harsen, for repairs; and seaplane, the Buckeye, engine overhauling.

SHIPYARDS AND DRYDOCKS

New Drydock, Staten Island, N. Y.—The new drydock of the New York Harbor Dry Dock Company, adjoining the new city piers, Clifton, S. I., was put in operation on Monday, October 16, a Standard Oil barge being the first boat to be lifted. The dock is 585 feet in length, 85 feet 7 inches wide between wings at bottom, 23 feet draft over keel blocks at low tide and will take ships up to 13,000 gross tons.

Plans Building Drydock, New Orleans, La.—The Algiers Dry Dock & Repair Company, of New Orleans, Edgar Berthaut, president, is planning to build a floating all-steel drydock capable of accommodating vessels up to 10,000 deadweight tons. The drydock will be 250 feet in length by 54 feet and will be operated by electric-driven centifrugal pumps. It is to cost about $400,000. The concern is contemplating increasing its capitalization to $500,000.

New Drydock, New Orleans, La.—The Algiers Dry Dock and Ship Repair Company, Inc., has begun work on another floating all-steel drydock, capable of accommodating vessels up to 10,000 deadweight tons and plan to increase the capital stock of the concern from $100,000 to $500,000. The new dock, when completed, will be more than four times as large as the present dock, which is capable of receiving ships up to 2,000 tons, and will represent a cost of approximately $400,000, according to officials of the company. It is expected that the new dock will be completed by April 1, 1923.

PORT IMPROVEMENTS

Quay Walls, Montreal, Que.—Harbor Commissioners of Montreal awarded contract to Atlas Construction Company, Belmont street, for extending high quay walls between Sections 25 and 35, 4,500 feet long. Price $450,000.

Bulkhead, Chicago, Ill. South Park Commissioners, Fifty-seventh street and Cottage Grove avenue, awarded the contract for 7,200 linear feet bulkhead to Great Lakes Dredge and Dock Company, 104 South Michigan avenue.

Contract Awarded, New York City.—The Morris & Cummings Dredging Company, 17 State street, New York, was awarded a contract by the Pennsylvania Railroad, Broad Street Station, Philadelphia, for dredging 180,000 cubic yards in South Amboy Harbor.

Contract Awarded, Norfolk, Va.—The contract for dredging the Norfolk channel to 40 feet in depth and widening to the eastward from the mouth to the junction of the Eastern and Southern Branches of the Elizabeth River, was awarded to the Fred E. Jones Dredging Company.

Developments of Harbor, Hamilton, Ont.—Hamilton Harbor Commission is having plans prepared for harbor front development and reclamation of land. Plans to proceed as soon as possible with first unit, costing $1,077,000, mostly reclamation work. Total, $13,000,000. A. Guy, chairman; E. V. Gray, city engineer; Gore, Nasmith & Storrie, Confederation Life Building, Toronto, engineers.

Harbor Improvements, Montreal, Canada.—Dominion Government, Ottawa, Ont., approved the following works for Montreal Harbor: Extending Jacques Cartier Pier 300 feet, $200,000; extending Alexander Pier 300 feet, $450,000; extending King Edward Pier 300 feet, $450,000; improving channel approach to Bickerdike Pier, $97,850; paving and extending Harbor Rv. terminals to new wharf levels, east of Section 25, $50,000. W. L. McDougall, chairman of Board of Harbor Commissioners; R. Harvie, chief engineer.

GOVERNMENT WORK

Barge, Montgomery, Ala.—Constructing Quartermaster, Montgomery, plans steel barge.

Catamarans, Savannah, Ga.—Constructing Quartermaster, Savannah, plans pontoon catamarans and pipe for dredge Morgan.

Pier Extension, Puget Sound, Wash.—Specification 4707—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans extending Pier 4.

Plans for Dredging, Puget Sound, Wash.—Specification 4708—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans dredging in Sound.

Barges, Florence, Ala.—U. S. Engineer awarded contract for 2 steel barges to Charles Ward Engineering Company, South Side, Charleston, W. Va. Price $34,000.

Dredge Pontoons, Etc., Mobile, Ala.—Penn Bridge Company, Beaver Falls, Pa., was awarded the contract for dredge pontoons and discharge pipe for U. S. Dredge Wahalak, by U. S. Engineer, Mobile. Price $28,903.

Steel Gates, Nashville, Tenn.—U. S. Engineer awarded contract to Penn Bridge Company, Beaver Falls, Pa., for steel gates for Lock F, Cumberland River. Price $22,783.

Barges, New Orleans, La.—U. S. Engineer, 329 Customhouse, awarded the contract for 2 steel oil barges in Mississippi River, to Midland Barge Company, Midland, Pa. Price $59,850.

Jetty Repairs, Jacksonville, Fla.—Waterfront Construction Company, Charleston, S. C., was awarded the contract for jetty repairs in St. Johns River, by U. S. Engineer. Price $5.87 per ton.

Catamarans, Portland, Ore.—The Williamette Iron and Steel Works, Portland, was awarded the contract for 80 steel pontoon catamarans for dredges Multnomah and Wahkiakum, by U. S. Engineer, Second District. Price $49,600.

Contract Awarded, New Orleans, La.—U. S. Engineer, 329 Custom House, awarded the contract for furnishing stone for Southwest Pass, Head of Pass and South Pass, Mississippi River, to O. F. Barrett, 2303 Grandview avenue, Cincinnati, Ohio. Price $216,480.

Contract Awarded, Philadelphia, Pa.—American Dredging Company, Mariner and Merchant Building, was awarded the contract for dredging in Delaware River on Bellevue, Cherry and Liston ranges, by U. S. Engineer, Witherspoon Building. Price $616,786.

Quay Walls, Etc., Pearl Harbor.—Specification 4591 Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded contract to E. J. Lord, McCandless Building, Honolulu, for quay walls and pier at Naval operating base at Pearl Harbor. Price $749,140; time 450 days.

Breakwater Construction, Indiana.—U. S. Engineer's Office, Room 1201, 537 South Dearborn St., Chicago, Ill., will receive sealed proposals for constructing concrete caisson breakwater at Indiana Harbor, Indiana, until 10 A. M., November 6, 1922. Further information on application.

Contract Awarded, Hampton Roads, Va. Specification 4689 Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded the contract for riprap protection for breakwater pier at Naval Operating Base, to Arundel Corporation, Pier 2, Pratt street, Baltimore, Md. Price $150,000.

Dredging, Philadelphia, Pa.—U. S. Engineer, Witherspoon Building, awarded contract to American Dredging Company, Mariner and Merchant Building, for dredging in Delaware River, on Bellevue, Cherry and Liston ranges. Price $616,786.

NEW INCORPORATIONS

Yonkers & Alpine Ferry Company, capital $300,000, chartered at Albany. Incorporators: W. F. Dee, J. Williamson and J. Schwartz.

Donnelly Dry Dock Company, of Manhattan, capital $250,000, chartered at Albany. Incorporators: W. T. and N. E. Donnelly and D. W. Barnes.

The Susquehanna Line, of New York, capital $100,000, chartered under Delaware laws, to do steamship business. The Susquehanna Steamship Company operates Shipping Board vessels from New York and Philadelphia to Scandinavian and Baltic ports.

FOREIGN ACTIVITIES

Steamship Launched, Germany.—The new North German Lloyd steamship Werra has been successfully launched. The Werra will be used in the line's China service. She is a vessel of approximately 9,000 gross tons, with a 12½-knot speed, and will carry sixty cabin and 1,400 third class passengers.

Construction Contract, Amsterdam, Holland.—The Nederland Shipbuilding Company (Nederlandsche Scheepsbouw-Maatschappy) Amsterdam, have obtained an order from the Colonial Department for a cable-ship for the East Indies, named Zuiderkruis. The ship's dimensions are to be as follows: Length over all, 290 feet 10 inches; breadth molded, 36 feet 9 inches; depth, 22 feet 2 inches. The engine installation will be supplied by Werkspoor, Amsterdam.

Ship Construction, Scotland.—Announcement is made that the Commonwealth Government of Australia has ordered five passenger liners of 13,850 gross tons to be built on the Clyde for its service from London to Fremantle via the Suez Canal, including a stop at Colombo, Ceylon, which is reached in 20 days. A special feature of these ships is that with the exception of six cabins for 12 passengers, the whole accommodation is for third class passengers, totaling about 700.

Ship Contract, England.—Elders & Fyffes, Ltd., British subsidiary of the United Fruit Company, have placed an order with Cammell, Laird & Company, of Birkenhead, for two new ships. The vessels will be mainly for the transportation of fruit, designed to handle 100,000 bunches of bananas each and having limited passenger accommodations. Their capacity will be about 5,000 gross tons and will run in the company's service between the banana fields and the United Kingdom and Continental ports. The United Fruit Company some time ago announced the placing of orders for two Diesel engined ships for its American trade.

Trial Trip, Holland.—According to advices received by the Holland-America Line, the trial runs of the company's new twin screw steamship Volendam have been very successful. The steamer satisfied every expectation as to speed and maneuvering and has proceeded to the Holland-America Line docks at Rotterdam, where she will be finished. The Volendam is an oil burning passenger steamer of 15,550 tons register, 24,000 tons displacement, and is to be added to the New York passenger service of the company. She is equipped with all modern conveniences. The vessel is scheduled to sail from Rotterdam for New York on her maiden voyage November 4. Her return voyage from New York to Rotterdam, via Plymouth and Boulogne-sur-Mer, will be November 21.

Trials of Tankship, England.—The steamship Solen, one of several oil tankships built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., for the Anglo-Saxon Petroleum Co., Ltd., of London, has run successful trials. The speed attained during a series of runs on the measured mile was over 12 knots. The Solen will carry benzine in bulk and is built on Isherwood's system of longitudinal framing to Lloyd's highest class. Her dimensions are 427 feet in length, breadth 53 feet 4 inches and molded depth to the upper deck 31 feet.

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Construction of 24-Inch Hydraulic Dredge Planned

PLANS and specifications are being prepared for the construction of a 24-inch hydraulic dredge for the United States Engineer Office, Room 405 Customhouse, Cincinnati, Ohio. The drawings and specifications are being worked up in the office of the Chief of Engineers, Washington, D. C., and it is expected they will be issued from the Cincinnati office in the near future.

BUSINESS NOTES

The Peabody Engineering Corporation has removed its office from 331 Madison Avenue to 110 E. 42nd Street, New York. They have taken considerably more space than their former office.

The Norman W. Henley Publishing Company, 2-4 and 6 West 45th Street, New York City, N. Y., will gladly send free to readers of MARINE ENGINEERING AND SHIPPING AGE a copy of their 1923 "Latest Catalogue of Practical and Radio Book," which they have just issued.

Lynn W. Nones has been appointed Eastern Manager of the Marine Department of the Diamond Power Specialty Corporation, with offices at 90 West Street, New York City. Mr. Nones was formerly manager of the Marine Department of the Griscom-Russel Company and was associated with them three and a half years. Previous to this connection Mr. Nones was with the Worthington Pump & Machinery Corporation.

The Babcock and Wilcox Company has established marine storerooms in Baltimore, Norfolk, New Orleans and San Francisco, through which proper material for B. & W. boilers may be obtained. In addition, they are establishing a marine storeroom in New York City, which will be stocked with spare and replace parts and tools. Orders placed in New York will be received at the company's office, 85 Liberty Street. For the convenience of its customers, the company has arranged a catalogue listing the various materials which may be required in connection with the operation of their boilers and may be obtained through the New York office or any of the storerooms.

TRADE PUBLICATIONS

REFRACTORY PRODUCTS.—The October bulletin of Laclede-Christy, St. Louis, Mo., contains articles on the value of clay products in the United States. The use of firebrick in glass plants, electric furnaces, metallurgical furnaces and the like.

ANTI-SLIP TILE.—A catalogue describing in detail a new non-slip tile for walking surfaces which is manufactured by the Carborundum Company, Niagara Falls, N. Y., is being sent out by the sales representatives, The American Abrasive Metals Company, New York.

"THE VALVE WORLD."—The October issue of the Crane Company, Chicago, bulletin contains several excellent business and economic editorials and a special feature article of the City of Pittsburgh, its industries and buildings, with special reference to Crane service in this district.

JAHNCKE DRY DOCKS.—A pamphlet containing photographs and a description of the plant and operation of the dry docking facilities of the Jahncke Dry Docks, Inc., New Orleans, La., has been published by this company. Statistics are also given of the importance of New Orleans as a shipping port.

DIESEL ENGINE STATISTICS.—A pamphlet containing diagrams compiled from "Lloyd's Daily Index" indicating the extent to which Burmeister and Wain Diesel engines are used in marine installations in direct comparison with the other types of marine Diesel engines has been sent out by Burmeister and Wain, Copenhagen, Denmark.

MARINE DIESEL ENGINES.—A complete illustrated catalogue of Werkspoor marine Diesel engines has been sent out by Werkspoor, Amsterdam, Holland. Details of the construction are given with special reference to unusual features of these engines. A special section is devoted to a description of the reversible propeller. A table of the standard size engines manufactured is also included.

OIL COOLERS.—The multi-whirl oil cooler and the heat exchanger produced by the Griscom-Russell Company, New York, are illustrated and described in Bulletin 910 recently sent out by this company. Among other purposes, these types of equipment are designed for cooling oil in turbines, transformers and the like. Special reference is made to the use of this equipment in oil refining service.

MODERN FLOORS.—A booklet intended to show the trend of modern practice in regard to flooring used in the construction of large buildings and the reasons for the success of present-day flooring methods is being distributed by the Marine Decking and Supply Company, Philadelphia, Pa. Details of the use of Lit-O-Sil-O flooring in various types of service with illustrations are given with a special section devoted to the use of this flooring aboard ship.

MALLEABLE NICKEL.—A resume of the properties and uses of pure malleable nickel is contained in Bulletin 101 issued by the American Nickel Corporation, Clearfield, Pa. The data are to a great extent tabulated and include the forms in which "American" nickel is produced, the purpose for which it is best adapted, its chemical and physical properties, the melting points of various metals, their specific gravities, standard gages for metal sheets and wire and other useful information.

BOILER SETTINGS AND CHIMNEYS.—A bulletin outlining the service of Ballard, Sprague and Company, Inc., New York, in the construction of boiler settings, chimneys, steel stacks, and the like, has been issued for the benefit of those interested in boiler plant and industrial power plant construction and repair. Details of interesting stack construction jobs with numerous photographs, as well as boiler settings, acid towers and other types of construction are featured.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander S. M. Robinson, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Asociation of Engine and Boat Manufacturers
29 West 39th Street, New York City.
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

The New York Tow Boat Exchange
11 Moore St., New York.
Secretary—Irving G. Keller.

Port of New York Authority
11 Broadway, New York.
Chairman—E. H. Outerbridge.
Secretary—William Leary.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
President—H. H. Raymond.
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

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